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THELYPTERIDACEAE OF AFRICA AND ADJACENT ISLANDS

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ABSTRACT

An attempt is made to provide a systematic account of all known species in the fern-family Thelypteridaceae in the whole of Africa and in adjacent islands in the Indian and Atlantic oceans. The species are arranged in the system of Old World genera proposed by the author in Blumea **19:** 17–52 (1971), with the object of showing the relationships of African species to those in Asia. Two groups of African species however have their nearest relatives in the New World and were not dealt with in the paper of 1971; these are the genus *Amauropelta*, and a new section *Palazoneuron* in the genus *Christella*. In some cases the adoption of the segregate generic names has involved the substitution of other specific epithets in place of those which are correct in *Thelypteris* and *Cyclosorus* as recognized in most recent works on African ferns.

Two interesting new cases of the relationship between the floras of the islands in the Gulf of Guinea and those in the Indian Ocean are mentioned: *Metathelypteris fragilis*, only known from one collection in Madagascar and one in S.Tomé; *Sphaerostephanos elatus*, well known in the Mascarene Islands, now reported with a new subspecies in S.Tomé. Seven new species are described.

UITTREKSEL

THELYPTERIDACEAE VAN AFRIKA EN OMLIGGENDE EILANDE

'n Poging word aangewend om 'n systematiese verslag van al die bekende soorte van die varingfamilie Thelypteridaceae in die hele Afrika en omliggende eilande in die Atlantiese en Indiese oseane daar te stel. Drie soorte word geplaas in die sisteem van Ou Wêreld genera voorgestel deur die skrywer in Blumea **19:** 17–52 (1971) met die doel om die verwantskappe tussen soorte uit Afrika en Asië aan te toon. Twee groepe soorte uit Afrika se naaste verwante kom egter in die Nuwe Wêreld voor en was nie in 1971 behandel nie; dit is die genus *Amauropelta* en die nuwe seksie *Palazoneuron* in die genus *Christella*. In sommige gevalle het die aanname van onderskeidende generiese name die vervanging van ander soort name genoodsaak in die plek van die wat korrek is in *Thelypteris* en *Cyclosorus* soos erken in die jongste werke oor die varings in Afrika.

Twee interessante gevalle van verwantskap tussen die floras van die eilande in die Golf van Guinea en die in die Indiese oseaan word genoem: *Metathelypteris fragilis*, van een versameling in Madagaskar en een in S. Tomé; *Sphaerostephanos elatus* wel bekend in die Maskarene-eilande nou gevind met 'n nuwe subspesie in S. Tomé. Sewe nuwe soorte word beskryf.

This paper is complementary to one published in 1971 (Blumea **19:** 17–52) in which I gave a conspectus of 23 genera of Thelypteridaceae in the Old World, but noted (p. 18) that there were some African species which appeared to have relatives in America and not in Asia. Since 1971 I have attempted to compile information on the species of this family in the Mascarene Islands, and in so doing have looked at all species in Africa and neighbouring islands in the Atlantic and Indian Oceans. I believe that I can now allocate all African species

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to species-groups, though two of the groups cannot be defined clearly until all the American representatives have been recognized (*Amauropelta* and *Parathelypteris*).

The total number of species in Africa and the islands, as here presented, is 55; in mainland Africa 34. This compares with 450–500 for Asia, Malesia and the Pacific (including many still undescribed). In dealing with this much more prolific region, I felt obliged to follow the lead of R. C. Ching (Acta Phytotax. Sinica **8:** 289–335; 1963) in recognizing a number of genera, for two reasons. The family is very polymorphous in Asia-Malesia, and extreme forms of various kinds are so different from each other that their segregation in separate genera appears appropriate, though there are also a large number of species which show less obvious differences. The other reason is that in naming a species in such a large assemblage it is necessary to give some indication of its relationships, and this is most easily done by recognition of separate genera. Ching dealt with the species of mainland Asia, but did not realize the magnitude of the problem presented by the far greater diversity in Malesia. Published descriptions of species in Malesia did not indicate any clear division into species-groups, and I decided that it was necessary to look for and describe characters hitherto ignored. I found that characters of sporangia and spores appeared to be particularly important, also details of the character and distribution of glands and hairs. Having thus looked at and re-described almost all types of published species, and also a very large number of other specimens, including some extensive recent collections, I devised a new classification, based on Ching's but considerably elaborated in various ways. Though it cannot be final, I believe that this classification does give significant information about natural groups of species and their distribution. One conclusion from this intensive study is that the classification adopted in Copeland's *Genera Filicum* (1947) is untenable in its separation of the genera *Lastrea* and *Cyclosorus* on the character of free or united veins; there are several natural species-groups which have some members with free and some with united veins. Therefore it appears to me that there are only two practicable alternatives: to include all Thelypteridaceae (perhaps 1 000 species) in one genus *Thelypteris*, or to recognize a number of different genera. For the large number of species in Asia-Malesia the latter course seemed to me imperative. I have therefore adopted it here also, for comparative purposes, for the species of Africa; but for persons who are concerned only with Africa, or a part of Africa, it is reasonable to adopt one genus *Thelypteris*, as Prof. Schelpe has done in his account of the ferns in *Flora Zambesiaca*.

Therefore in the present account I have set out the genera as I see them, and have included new combinations where these are called for, but I have also indicated the appropriate name in *Thelypteris* (in a few cases this has a specific epithet different from the correct one in the genus I adopt). It will be seen that some African species, including those here described as new, still lack names in *Thelypteris.*

Under each species is cited the designated type, and its location if known (with ! to indicate that I have examined it), and also the types of basionyms regarded as synonyms. Each paragraph of a synonymy consists of names which are all based on the same type. Also cited are Prof. Schelpe's account of ferns in *Flora Zambesiaca*, and the recent works of Alston and Tardieu-Blot on the ferns of other parts of Africa.

KEY TO THE GENERA

- 1 Veins all free, or basal veins sometimes touching below the sinus between two pinna-lobes:
  - 2 Fronds bipinnate, with free or ± adnate pinnules:
    - 3 Slender septate hairs present on lower surface of frond-axes . . 1. *Macrothelypteris*
    - *3* Slender septate hairs lacking:
      - 4 Sori indusiate; largest pinnae under 10 cm long . . . . . . 2. *Metathelypteris*
      - *4* Sori exindusiate; fronds much larger . . . . 3. *Pseudophegopteris*
  - *2* Fronds simply pinnate with deeply lobed pinnae:
    - 5 Several pairs of lower pinnae gradually reduced:
      - 6 Caudex stout, erect . . . . 4. *Amauropelta*
      - *6* Caudex a slender creeping rhizome . . . . .5. *Parathelypteris*
    - *5* An abrupt transition to much-reduced pinnae at base of frond, *or* a few pairs lower pinnae gradually and not greatly reduced:
      - 7 An abrupt transition to much-reduced basal pinnae:
        - 8 Reduced pinnae very numerous; spores bearing many small wings of uniform size . . . . 6. *Pseudocyclosorus*
        - *8* Reduced pinnae 3–6 pairs; spores bearing less numerous wings of varying size . . . . 7. *Christella*
      - *7* A few pairs of pinnae gradually somewhat reduced, *or* no reduced pinnae:
        - 9 Sori exindusiate:
          - 10 Sporangia setose; basal veins not meeting at sinus:
            - 11 Sori running along veins; spores with many small wings . . . 8. *Stegnogramma*
            - *11* Sori almost round; spores smooth or with a slight raised reticulum 3. *Pseudophegopteris*
          - *10* Sporangia not setose; basal veins meeting below a triangular sinus-membrane . . . . 4. *Amauropelta*
        - *9* Sori indusiate:
          - 12 Rhizome slender, long-creeping; fronds almost hairless beneath with broad scales on costae . . . . 9. *Thelypteris*
          - *12* Rhizome not slender; fronds always conspicuously hairy beneath, no scales on costae . . . . 7. *Christella*
- *1* At least the basal pair of veins regularly anastomosing with excurrent vein running to the sinus (in *Amphineuron* sometimes free on parts of a frond):
  - 13 Rhizome long-creeping; thin scales on lower surface of costae; no reduced basal pinnae . . . 10. *Cyclosorus*
  - *13* Not this combination of characters:
    - 14 Exindusiate:
      - 15 Numerous buds on rachis resulting in much proliferation; forked hairs present on rachis. . . . 11. *Ampelopteris*
      - *15* At most one bud on rachis; no forked hairs:
        - 16 Pinnae to 1 cm wide; spores subspherical, minutely papillose . . . . .12. *Menisorus*
        - *16* Pinnae on mature plants much wider; spores otherwise. . . . . . . 13. *Pneumatopteris*

- *14* Indusiate:
  - 17 Yellow or whitish capitate hairs abundant at least along distal parts of veins of lower surface; sori confined to pinna-lobes . . . 14. *Amphineuron*
  - *17* Not this combination of characters:
    - 18 Sporangia setose:
      - 19 Lower surfaces conspicuously hairy; c. 6 pairs of small reduced basal pinnae 15. *Sphaerostephanos*
      - *19* Lower surfaces minutely hairy; 2–3 pairs reduced basal pinnae. . . . 13. *Pneumatopteris*
    - *18* Sporangia not setose, in some cases bearing glands:
      - 20 Yellow spherical glands present on lower surface of lamina and on sporangia. 15. *Sphaerostephanos*
      - *20* Yellow spherical glands lacking:
        - 21 Basal pinnae rather abruptly reduced; lamina ± pustular when dried; spores with many small wings 13. *Pneumatopteris*
        - *21* Basal pinnae gradually reduced; lamina not pustular; wings on spores fewer and irregular . . 7. *Christella*

1. *MACROTHELYPTERIS* (H. Ito) Ching.

Acta Phytotax. Sinica **8:** 308 (1963)

Caudex suberect; scales narrow, ± thickened at base, with marginal and superficial acicular and capitate hairs; fronds bipinnate-tripinnatifid with ± adnate pinnules; scales on fronds, if present, with thickened bases, ± setose margin and hair-tip; hairs on frond acicular and capitate, some long septate hairs always present; sori small, usually with a small indusium; sporangia usually with capitate hairs near annulus; spores with a ± winged perispore. Chromosome number 31.

Nine species; tropics of the Old World from Mascarene Islands to Hawaii and Queensland.

1. **Macrothelypteris torresiana** (Gaud.) Ching, Acta Phytotax. Sinica **8:** 310 (1963); Holtt. Blumea **17:** 27 (1969) excl. syn. *Polypodium fragile* Bak.—*Polystichum torresianum* Gaud. in Freyc., Voy. Bot. **: 333** (1824).—*Thelypteris torresiana* (Gaud.) Alston in Lilloa **30:** 111 (1960). Type: Mariana Isl., *Gaudichaud* (G !).

Aspidium uliginosum Kunze in Linnaea **20:** 6 (1847).—*Dryopteris uliginosa* (Kunze) C. Chr., Ind. Fil. Suppl. **3:** 100 (1934).—*Thelypteris uliginosa* (Kunze) Ching in Bull. Fan Mem. Inst. Biol. Bot. **6:** 342 (1936); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 284 (1958). Type: cult. Hort. Bot. Leipzig, origin Java (formerly LZ, now destroyed).

Polypodium tenericaule Hook. in J. Bot. Kew Misc. **9:** 353 (1857).—*Lastrea tenericaulis* Moore, Ind. Fil. : 99 (1858); Bedd., Handb. Ferns Brit. India: 266 (1883).—*Nephrodium tenericaule* Hook., Spec. Fil. **4:** 142, p.p. excl. t. 269 (1962). Type: China, *Alexander* (K !).

Nephrodium setigerum (Bl.) Hook & Bak., Syn. Fil.: 284, p.p. (1867).—*Dryopteris setigera* (Bl.) C. Chr., Ind. Fil.: 292, p.p. (1905).

Dryopteris lasiocarpa Hayata in J. Coll. Sci. Univ. Tokyo **30:** 417 (1911).—*Thelypteris oligophlebia* var. *lasiocarpa* (Hayata) H. Ito in Nakai & Honda, Nov. Fl. Jap. pt. **4:** 144 (1939). Type: Formosa, *Nakahara 994* (TI).

Dryopteris trichodes Rosenst. in Meded. Rijksherb. Leiden **31:** 6, p.p. (1917). Lecto: Java, *Zollinger 354* (L !).

Stipes glaucous, with dark brown scales at base; no scales on axes of frond, but long septate slender hairs always present on lower surface of axes; indusium small, bearing capitate hairs.

Madagascar, Reunion; also throughout range of genus. Now naturalized in various parts of the Americas.

2. *METATHELYPTERIS* (H. Ito) Ching

Acta Phytotax. Sinica **8:** 305 (1963).

Small ferns with short erect caudex; fronds pinnate with deeply lobed pinnae or bipinnate with adnate pinnules; basal pinnae not or little reduced; veins in pinna-lobes free, often forked, always ending short of the margin; costae prominent, not grooved, on upper surface; unicellular acicular hairs and/or short capitate hairs on lower surfaces, also short hair-like reduced scales consisting of several short cells with brown septa; sori indusiate; sporangia lacking hairs near annulus; chromosome number 35.

About 12 species; S. Tomé, Madagascar, India and Ceylon to S. China and Japan, Malesia, Solomon Islands.

1. **Metathelypteris fragilis** (Bak.) Holtt., comb. nov.—*Polypodium fragile* Bak. in Journ. Linn. Soc. Bot. **16:** 203 (1877). Type: Madagascar, *H. Gilpin* (K !).

Stipe probably 15–20 cm long; lamina 20 cm long, pinnae c. 8 pairs, opposite; basal pinnae a little shorter than next, narrowed near their bases; largest pinnae 6,5 × 2,0 cm, with a few free pinnules at their bases, connected by a very narrow wing along pinna-rachis; pinnules on basiscopic side of pinna longer than on acroscopic, largest 1,3 × 0,5 cm, lobed more than ½ way to midrib; veins pinnate in larger pinnule-lobes; acicular hairs on axes, both surfaces; one sorus on basal acroscopic branch of each vein; indusia with capitate hairs.

Only known from the type, and one specimen from S. Tomé (*Newton s.n.* 1885, K, ex Coimbra).

This species was wrongly included in a synonymy of *Macrothelypteris torresiana* (q.v. supra) by Holttum in Blumea **17:** 27 (1969).

3. *PSEUDOPHEGOPTERIS* Ching

Acta Phytotax. Sinica **8:** 313 (1963).

Caudex of African species erect or suberect; scales thin, crumpled and medium brown when dry, bearing short superficial hairs but not conspicuous marginal and apical hairs; fronds usually elongate with lower pinnae ± reduced and more widely spaced; pinnae opposite or nearly so, bearing adnate pinnules which are ± deeply lobed (in *P. dianae* no free pinnules); upper surface of costae not grooved; veins usually forked, not reaching margin; unicellular acicular and/or capitate hairs, also much-reduced filiform scales present on lower surface of frond-axes; sori exindusiate; sporangia setose only in *P. dianae;* spores with a slightly raised surface reticulum or sometimes lacking distinct surface features; chromosome number 31. Twenty species, distributed from St. Helena to Hawaii.

Fronds pinnate, without free pinnules . . . . 1. *P. dianae*
Fronds bipinnate:
  Basal basiscopic pinnules conspicuously longer than next; lower surfaces throughout bearing abundant short blunt hairs . . . . 2. *P. henriquesii*
  Basal basiscopic pinnules not conspicuously longer than next; acicular hairs only on lower surfaces:
    Basal pinnules of larger pinnae smaller than middles ones . . . 3. *P. aubertii*
    Basal pinnules of larger pinnae not reduced . . . . 4. *P. cruciata*

1. **Pseudophegopteris dianae** (Hook.) Holtt. in Blumes **17:** 21 (1969).—*Polypodium dianae* Hook., Spec. Fil. **4:** 234 (1863); J. C. Mellis, St. Helena: 355, pl. 55 (1875).—*Dryopteris dianae* C. Chr., Ind. Fil.: 262 (1905). Type: St. Helena, *Cuming 423* (K !).

Polypodium molle Roxb. in Beatson, St. Helena: 318 (1816), non Jacq.; Hook. & Bak., Syn. Fil.: 308 (1867).—*Phegopteris mollis* Kuhn, Fil. Afr.: 123 (1868), non Mett. Type: St Helena, *Roxburgh s.n.* 1813–14 (BR ?).

Stipe 15–35 cm, densely and persistently scaly throughout (also lower surface of rachis), scales thin, to 6 × 2½ mm; lamina to more than 50 cm long and 30 cm wide; pinnae contiguous or overlapping, lowest pair slightly reduced with narrowed bases; largest pinnae commonly 16 × 3½ cm (to 22 × 7 cm), lobed to 1–3 mm from costa, basal basiscopic segments longest; segments of larger pinnae crenate; lower surfaces of costae and costules densely hairy; veins pinnate in lobes of pinna-segments; sori one or more to each vein-group, round or slightly elliptic; sporangia setose; spores thin-walled without evident markings.

Distribution: St. Helena; reported by Mellis in 1862 as a very common roadside fern along Sandy Bay Ridge; found also in 1956 (*N. R. Kerr.* K).

2. **Pseudophegopteris henriquesii** (Bak.) Holtt. in Blumea **17:** 15 (1969).—*Polypodium henriquesii* Bak. in Bol. Soc. Brot. **4:** 154, t.1 (1886).—*Dryopteris henriquesii* C. Chr., Ind. Fil.: 270 (1905); Exell, Cat. Vasc. Pl. S. Tomé: 64

(1944).—*Thelypteris henriquesii* Tard. in Notul. Syst. **14:** 344 (1952); Mem. Inst. Franc. Afr. Noire no **28:** 119, pl. xx, f. 10, 11 (1953).—*Macrothelypteris henriquesii* Pichi Sermolli in Webbia **23:** 179 (1968). Type: S. Tomé, 1 200 m, *A. Moller 45* (K !).

Main rachis reddish at base, stramineous distally; lowest pinnae a little reduced; longest pinnae 20–35 × 6–15 cm, bearing broadly adnate pinnules connected by a narrow wing, basal basiscopic pinnules elongate; largest pinnules to 8 × 1,7 cm, lobed up to $\frac{3}{4}$ towards costule, veins pinnate in lobes; lower surfaces throughout bearing many short erect hairs with rounded little-swollen apices (similar hairs also between veins on upper surface) and also acicular hairs; sori medial on veins; sporangia not setose; spores not seen.

Distribution: S. Tomé.

3. **Pseudophegopteris aubertii** (Desv.) Holtt. in Blumea **17:** 18 (1969).—*Polypodium aubertii* Desv. in Mem. Soc. Linn. Paris **6**: 243 (1827).—*Macrotholypteris aubertii* Pic. Ser. in Webbia **23:** 177, fig. 2 (1968). Type: "Ins. Mascareigne" (on label: Bourbon), no collector cited (P).

Phegopteris helliana Fée, Gen. Fil.: 247 (1852). Type: Réunion, *de Hell* (isotype? P !).

Polypodium sharpeanum Bak. in Journ. Bot. **18:** 369 (1880).—*Dryopteris sharpeana* C. Chr., Ind. Fil.: 292 (1905). Type: Madagascar, *L. Kitching* (K !).

Main rachis stramineous or flushed with red; pinnae to at least 40 × 15 cm; basal pinnules smaller than middle ones; largest pinnules 8 × 2,5 cm, acuminate, lamina at base slightly adnate on acroscopic side, lobed almost to costa, segments slightly oblique, to 4 mm wide, lobed up to $\frac{1}{2}$ way to their midribs; lower surfaces of pinna-rachis, costae and costules bearing spreading pale hairs; sori 1 or 2 to each lobe of a pinnule-segment; sporangia not setose; spores with a slightly raised reticulum of large meshes.

Distribution: Réunion, Madagascar. Desvaux's description is detailed, and Pichi Sermolli has published a photograph of the type.

4. **Pseudophegopteris cruciata** (Willd.)Holtt. in Blumea **17:** 21 (1969). *Aspidium cruciatum* Willd. in L. Spec. Pl. ed. iv, **5:** 278 (1810).—*Dryopteris cruciata* C. Chr., Ind. Fil.: 259 (1905).—*Thelypteris cruciata* Tard. in Notul. Syst. **15:** 91 (1955); Alston, Ferns W. Trop. Afr.: 61 (1959); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 285, fig. xl, 7–9 (1958).—*Macrothelypteris cruciata* Pichi Sermolli in Webbia **23:** 179 (1968). Type: Mauritius, *Bory* (*Herb. Willd. no. 19821*, B !).

Phegopteris straminea Fée, Gen. Fil.: 246 (1852). Type: Réunion, *de Montbrison* (orig. ?; dupl. FI !).

Polypodium bojeri Hook., Spec. Fil. **4:** 290 (1862). Type: Mauritius, *Bojer* (K !).

Nephrodium subglandulosum Bak., Syn. Fil.: 285 (1867). Type Réunion, *Vieillard & Deplanche s.n.* (K !).

Caudex erect; stipes to 30 cm or more long, stramineous or ± rufous; lamina to 100 cm or more long, lowest 2–3 pairs pinnae gradually reduced; largest pinnae to 25 cm long, basal basiscopic pinnules not much longer than next; pinnules to 5 × 1,5 cm, distinctly narrowed at base but always adnate to pinna-rachis, larger ones deeply lobed, edges of lobes crenate; lower surface of frond-axes bearing slender hairs; veins simple or forked; sori on acroscopic vein-branches, not or little elongate; sporangia lacking hairs; spores not seen.

Distribution: Mascarene Islands; Tanzania, Kenya, Uganda, Congo, Ghana, Cameroons, Liberia.

It seems possible that West African specimens represent a distinct species. Plants of *P. cruciata* may be fertile from a rather early age, and comparison of small fronds from young plants with much larger fronds from mature plants is difficult, especially when different parts of a frond are represented in different collections. These plants need more field study, also cytological study. A plant from West Africa was found to be tetraploid (see Alston 1959).

4. *AMAUROPELTA* Kunze

Farnkr. **1:** 86, 109, t. 51 (1843).

Caudex erect, basal part often covered with a mass of tangled roots as in *Cyathea;* scales firm, rather broad, bearing a few superficial hairs; stipes short; fronds gradually attenuate to both base and apex; aerophores at bases of pinnae usually swollen; pinnae deeply lobed; veins simple (except in enlarged basiscopic pinna-lobes), basal ones passing to margin above base of sinus (except in *A. membranifera*); sessile hemisperical glands sometimes present on lower surface; capitate hairs of various sizes, sometimes orange or red, and acicular hairs, variously present on lower surface, the acicular hairs sometimes hooked; sori of African species with very small indusia bearing acicular and/or glandular hairs; sporangia short-stalked, lacking hairs or glands near annulus; spores opaque and indistinctly granular; chromosome number 29.

Type species: *A. breutelii* Kunze of West Indies, placed by Christensen as a synonym of *Aspidium limbatum* Sw.

The name *Amauropelta* means obscure indusium. American species have not all yet been distinguished as a group, though almost all are described in Christensen's Monograph of *Dryopteris* (1913) in subgenus *Lastrea.* When dealing with *A. bergiana* in Madagascar Christensen mentioned its similarity to one of the American species. African species are fewer than American, and have not yet been clearly characterized. The following account is tentative, and there are possibly other species which should be recognized. Most species in Africa seem to be variable in the character of their pubescence. *A. membranifera* is aberrant in its connivent or sometimes united basal veins, and apparently also in its lower pinnae not much decrescent, but it agrees with *A. bergiana* in its hooked hairs, a character not known in any other African fern of this family.

C. C. Wood has published photographs of spores of American species as seen with a scanning electron microscope; they show a surface with a raised reticulum of a large number of very small meshes (Journ. Linn. Soc. Bot. **67,** Suppl.: 199, pl. 2 E, F, 3A, 1973). T. G. Walker has examined West Indian species cytologically, and was the first person to record the chromosome number 29 (Trans. R. Soc. Edinb. **66,** no. 9: 179, 214–217). He recorded this number for nine diploid species and one (unnamed) tetraploid. *A. bergiana* from Tristan da Cunha has been examined cytologically by Manton and Vida (Proc. R. Soc. B, **170:** 361–379. 1968) under the name *Thelypteris tomentosa.* They found $n = 84$–87, $2n =$ c. 170, which they interpret as hexaploid on $n = 29$. In the herbaria at Kew and the British Museum all specimens from Tristan named *T. tomentosa* are *Amauropelta bergiana* according to the present treatment. No cytological observations of this genus in Africa have been published. Atkinson and Stokey have described gametophytes of West Indian species of this genus (Journ. Linn. Soc. Bot. **66:** 23–36, 1973).

In erect caudex and shape of sporangia this genus agrees with *Coryphopteris* of the Malayan region, but it differs in the gradually decrescent base of the frond and in spores; the large glands in the two genera also probably differ in their form and structure, a subject perhaps amenable to modern micro-chemical investigation. In frond-form and shape of sporangia *Amauropeltis* agrees with *Oreopteris,* but differs in spores, in venation and in glands. *Oreopteris limbosperma,* widely distributed in north temperate regions, occurs in Madeira but nowhere in Africa. Only two other species are certainly known but more may await recognition.

- Lower pinnae with one or both basiscopic segments enlarged both in length and width, and lobed:
  - Lowest veins connivent just below sinus or anastomosing with short excurrent vein; sinus-membrane broadly triangular . . . . 1. *A. membranifera*
  - Lowest veins passing to edge above base of sinus . . . . 2. *A. heteroptera*
- Lower pinnae sometimes with ± enlarged basal segments but these segments not much widened or lobed:
  - Glands and capitate hairs lacking on all parts of surface; indusia bearing acicular hairs only . . . . 3. *A. bergiana*
    - Hooked hairs present on lower surface between veins . . . . . var. *bergiana*
    - Hooked hairs absent . . . . var. *calva*
  - Glands and/or capitate hairs present on lower surfaces and/or indusia:
    - Lower surface of rachis and costae bearing rather sparse stiff hairs 1 mm or more long; sori supramedial . . . . 4. *A. strigosa*
    - Lower surfaces of rachis and costae bearing rather copious shorter hairs; sori medial:
      - Large hemispherical glands abundant on lower surface between veins; basal pinnae not widely spaced, lowest c. 1 cm long . . . . . . 5. *A. tomentosa*
      - Large hemispherical glands absent; basal pinnae widely spaced, lowest 2–3 mm long . . . . *A. oppositiformis*.6

1. **Amauropelta membranifera** (C. Chr.) Holtt. comb. nov.—*Dryopteris membranifera* C. Chr. in Bonap. Notes Pterid. **16:** 170, pl. 2c (1925); Dansk. Bot. Ark. **7:** 50 (1932).—*Cyclosorus membranifera* Ching, Bull. Fan Mem. Inst. Biol. Bot. **10:** 246 (1941); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 289, fig. xli, 13–15 (1958).—*Thelypteris membranifera* Reed in Phytologia **17:** 292 (1968). Type: Madagascar, *Perrier 6067* (P !).

Caudex and base of stipe unknown; lamina to 80 cm long, 1–2 pairs basal pinnae somewhat reduced. Largest pinnae 15–20 cm long, to 3 cm wide, basal acroscopic segment of lower pinnae much enlarged (to 3 × 1,5 cm) and deeply lobed with veins pinnate in the lobes; apex long-acuminate; edges lobed to 2 mm from costa, lobes subfalcate, slightly crenate, a broadly triangular translucent membrane at base of each sinus; costules 6 mm apart, veins 10–11 pairs, lowest pair connivent below sinus-membrane, or joining, with a very short excurrent vein; lower surface of rachis glabrous, costae densely short-hairy, hairs present also on costules, veins and surface, many of them hooked at tips; upper surface hairy on rachis and costa only. Sori small, inframedial, exindusiate.

Distribution: only known from two collections from Madagascar. The second collection (*Humbert 12027*) is quite glabrous beneath, but otherwise very close to the type. This species needs further study.

2. **Amauropelta heteroptera** (Desv.) Holtt., comb. nov.—*Nephrodium heteropterum* Desv. in Mem. Soc. Linn. Paris **6:** 256 (1827).—*Aspidium heteropterum* Mett. ex Kuhn, Fil. Afr.: 134 (1868).—*Dryopteris heteroptera* C. Chr., Ind. Fil.: 270 (1905); Dansk Bot. Ark. **7:** 45 (1932).—*Thelypteris heteroptera* Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 276, fig. xxxviii, 6–10 (1958). Type: Mascarene Islands, no collector cited (P !).

Polypodium sieberianum Kaulf. in Spreng., Syst. Veg. ed. 16, **4:**56 (1827). Type: Bourbon, *Sieber* (P !).

Phegopteris scalpturata Fée, Gen. Fil.: 245 (1852). Type: Bourbon, *Pervillié* (P !).

Aspidium stipulaceum Mett., Farngatt. IV: 82, no. 198 (1858). Type: Bourbon, *Bory* (not seen).

Stipe 5–8 cm long, short-hairy; lamina 30–90 cm long, gradually narrowed in basal part but lower pinnae not widely separated, lowest c. 1 cm long, triangular with truncate base dilated equally both sides. Largest pinnae commonly 8–12 × 1,8–3,0 cm (to 18 = 3 cm); basal segments both ± enlarged, usually about twice as wide as other segments and crenate to deeply lobed with veins pinnate in the lobes; edges lobed to 1½–2 mm from costa, lobes hardly falcate; costules 3½–5½ mm apart; veins 10–15 pairs, rather thick and prominent; lower surface of rachis and costae with dense spreading hairs to ½ mm long, shorter and less dense on other parts, glands and capitate hairs lacking (one collection is quite glabrous beneath); upper surface short-hairy throughout. Sori medial, sometimes distinctly elongate; indusium small, bearing acicular hairs of varying length and sometimes glands.

Distribution: all specimens seen are from Réunion (Bourbon).

Christensen (Ind. Fil.: 260) places *Polypodium sieberianum* Kaulf. as a synonym of *Polypodium cyatheifolium* Desv.; I did not find the type of the latter at Paris.

3. **Amauropelta bergiana** (Schlechtend.) Holtt., comb. nov.—*Polypodium bergianum* Schlechtend., Adumbr. Fil. Prom. B. Spei: 20, t. 9 (1825).—*Aspidium bergianum* Mett., Farngatt. IV: 79 (1858).—*Lastrea bergiana* Moore, Ind. Fil.: 86 (1858).—*Nephrodium bergianum* Bak., Syn. Fil.: 269 (1867).—*Dryopteris bergiana* Kuntze, Rev. Gen. Pl. **2:** 812 (1891); Sim, Ferns S. Afr. ed. 2: 93, t. 10 excl. fig. b & c (1915); C. Chr., Dansk. Bot. Ark. **7:** 44, pl. 9, fig. 6–12 (1932).—*Dryopteris prolixa* var. *bergiana* Alston apud Gilliland in J. S. Afr. Bot. **4:** 149 (1938).—*Thelypteris bergiana* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 251 (1941); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 277, fig. xxxvii, 5–8 (1958); Schelpe, Fl. Zamb. Pterid.; 193, t. 55, fig. B (1970). Type: Kirstenbosch, *Bergius et al.* (not seen).

Nephrodium sewellii Bak. in Journ. Linn. Soc. Bot. **15:** 418 (1876).—*Dryopteris sewellii* C. Chr., Ind. Fil.: 292 (1905). Type: Madagascar, *Pool s.n.* (K!).

Nephrodium anateinophlebium Bak. in Journ. Linn. Soc. Bot. **16:** 202 (1877). —*Dryopteris anateinophlebia* C. Chr., Ind. Fil.: 252 (1905). Type: Madagascar, *H. Gilpin* (K !).

Aspidium maranguense Hieron. in Engl. Pflanzenw. Ost. Afr., C: 85 (1895).—*Dryopteris maranguensis* C. Chr., Ind. Fil.: 276 (1905).—*Lastrea maranguensis* Copel., Gen. Fil.: 139 (1947). Type: Kilamandjaro, *Volkens 1267* (B).

Dryopteris palmii C. Chr. in Ark. for Bot. 14, no. 19: 1, t. 2, f. 6 (1916). Type: Madagascar, *Afzelius & Palm* (C).

Caudex erect; stipes 5–17 cm long, short-hairy; lamina 30–90 cm long, lower pinnae gradually decrescent and more widely spaced, often narrowed at their bases. Largest pinnae 7,5–15 × 1,5–2,5 cm; base truncate, not dilated; apex acuminate; edges lobed to 1–2 mm from costa; lobes slightly oblique, hardly falcate; costules 3–4 mm apart; veins 8–10 pairs; lower surface of rachis, costae and costules bearing short spreading hairs some of which are hooked, slender erect hooked hairs on lower surface between veins; upper surface short-hairy throughout. Sori supramedial, small; indusia very small, bearing a few hairs.

Distribution: Madagascar, Réunion, S. Africa, Tanzania, Malawi, Zambia, Rhodesia, Kenya, Fernando Po.

Var. *calva* Holtt., var. nov., ab varietate typica differt: rachide, costis costulisque subtus pilis brevibus rectis praedita, pilis hamatis destitutis; lamina inferiori inter venas calva. Type: Cameroon Mt, Mann's Spring, *P. W. Richards 4308* (K). Also Cameroon Mt, 4 400 ft, *Maitland 1134* (K). Specimens from Comoro Islands (*Humblot 270*) and Réunion (*Herb. Richard 284*) similarly lack hooked hairs.

Var. *tristanensis* Holtt., var. nov., ab varietate typica differt: frondibus minoribus, subtus pilis longioribus numerosioribus praeditis; pinnis inferioribus basi dilatatis. Type: Tristan da Cunha, *Carmichael* (K). As noted above, similar plants from Tristan have been found to be hexaploid.

4. **Amauropelta strigosa** (Willd.) Holtt., comb. nov.—*Aspidium strigosum* Willd., in Linn. Sp. Pl. ed. IV, **5:** 249 (1810).—*Dryopteris strigosa*, C. Chr., Ind. Fil.: 295 (1905); Dansk Bot. Ark. **7:** 45 (1932).—*Thelypteris strigosa* Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 274, fig. xxxviii, 11–15 (1958). Type: Mauritius, *D. Flügge* (*Herb. Willd. 19,778*, B !).

Lamina commonly to 50 cm (to 90 cm) long, lower 7–10 pairs pinnae gradually reduced. Largest pinnae commonly 12–15 × 1,5–2,5 cm (width above base); base truncate with both basal segments ± elongate but entire; apex evenly attenuate; edges lobed to 1 mm from costa; costules 3 mm apart; veins 8–10 pairs; lower surface of rachis and costae bearing scattered stiff pale spreading hairs 1 mm or more long; broad resinous glands on surfaces sparse, smaller spherical ones occasional on costules and veins; upper surface short-hairy on edges of costal groove, with a few short hairs distally on costules and veins. Sori supramedial; indusia very small with a few glands and/or short hairs.

Distribution: Mauritius, Réunion; Madagascar?

There are specimens from Mauritius and Réunion which are intermediate between typical *A. strigosa* and *A. tomentosa*. These specimens have varying numbers of shorter hairs on the lower surface of rachis and costae (in some cases minute spreading hairs only, in some many hairs $\frac{1}{4}$–$\frac{1}{2}$ mm long), and large glands varying from many as in *A. tomentosa* to none. Sori in some cases are almost medial.

As noted by Christensen (*l. c.* 1932) it is doubtful whether this species exists in Madagascar; I have not seen the specimens cited by Tardieu.

5. **Amauropelta tomentosa** (Thouars) Holtt., comb. nov.—*Polypodium tomentosum* Thouars, Fl. Tristan d'Ac.: 32, t. 3 (1804).—*Nephrodium tomentosum* Desv., Mem. Soc. Linn. Paris **6:** 256 (1827).—*Dryopteris tomentosa* Kuntze, Rev. Gen. Pl. **2:** 813 (1891); C. Chr., Dansk. Bot. Ark. **7:** 45 (1932).—*Thelypteris tomentosa* Ching, Bull. Fan Mem. Inst. Biol. Bot. **10:** 255 (1941). Type: Tristan da Cunha, *Thouars* (P !).

Aspidium riparium Bory ex Willd. in Linn. Sp. Pl. ed. IV, **5:** 250 (1810). Type: Réunion, *Bory 82* (*Herb. Willd. no. 19,782*, B !).

Stipes to 7 cm long; lamina 30–45 cm; 5–6 pairs lower pinnae gradually reduced, ± triangular with truncate base enlarged on acroscopic side, lowest 1 cm long. Largest pinnae to 12 cm long, to 2,5 cm wide above base; basal segments ± elongate, basiscopic sometimes more than acroscopic; apex gradually attenuate; edges lobed to 1–1½ mm from costa; costules to 4 mm apart; veins 8–10 pairs; lower surface of rachis densely covered with erect hairs ⅕ mm long, similar but shorter hairs on costae, few hairs on costules; whole lower surface bearing many large red hemispherical glands; upper surface ± densely short-hairy throughout. Sori medial; indusia very small, bearing red glands.

Distribution: apart from the type, only known from Réunion and Mauritius. It seems possible that the type was wrongly localized; all other specimens from Tristan da Cunha named *Thelypteris tomentosa* in the herbaria at Kew and BM are *A. bergiana.* The figure published by Tardieu in Humbert, Fl. Madag. 5e Fam. **1**; fig. xxxviii, 1–5, is more densely hairy than any specimen of the species seen by me, and rather large hairy indusia are indicated; Christensen (*l. c.* 1932) stated that he had seen no specimens from Madagascar.

6. **Amauropelta oppositiformis** (C. Chr.) Holtt., comb. nov.—*Dryopteris oppositiformis* C. Chr. in Bonap. Notes Pterid. **16:** 173, t. 2 (1925).—*Thelypteris oppositiformis* Ching, Bull. Fan Mem. Inst. Biol. Bot. **10:** 253 (1941); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 272, fig. xxxvii, 1–4 (1948). Type: Madagascar, *Perrier 7582* (P !)

Dryopteris tsaratananensis C. Chr., Dansk. Bot. Ark. **7:** 45, pl. 9, fig. 1–5 (1932). *Thelypteris tsaratananensis* Ching, Bull. Fan Mem. Inst. Biol. Bot. **10:** 255 (1941); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 278 (1958). Type: Madagascar, Mt Tsaratanana, *Perrier 16455* (P !).

Thelypteris strigosa sensu Schelpe, Fl. Zamb. Pterid.: 193 (1970).

Stipes 2–7 cm long; lamina to 60 cm long, lower pinnae gradually smaller and more widely spaced, lowest 2–3 mm long. Largest pinnae 6–9 × 1,0–1,5 cm; base truncate, not enlarged either side; apex acuminate; edges lobed to 1–1½ mm from costa; lobes slightly oblique, hardly falcate, tips rounded to broadly pointed; costules 2–3 mm apart; veins to 7 pairs; short-stalked or sessile reddish glands of varying size present on costules and veins of lower surface, rachis and costae with short erect hairs; upper surface of costae and costules hairy, hairs between veins few or none. Sori medial or a little inframedial; indusia small, bearing a few short acicular and glandular hairs.

Distribution: Madagascar, Uganda, Kenya, Tanzania, Ethiopia, Sudan, Nigeria, Cameroons, Rhodesia.

The specimens here included vary considerably in the abundance and nature of their glandular hairs; most of them were formerly named *T. bergiana.*

Christensen distinguished *A. oppositiformis* from other Madagascan species by its narrow fronds (the type has a frond 5 cm wide), but other specimens with wider fronds agree with the type in essential characters. He distinguished *D. tsaratananensis* by lack of glands on the lower surface, but the type has distinct stalked orange glands quite similar to the smaller glands on the type of *A. oppositiformis*.

Some of the specimens referred here from Kenya, Uganda and elsewhere in Africa have ± enlarged basal pinna-lobes, in extreme cases toothed. It may be that these should be separated, but I do not see a clear division, and there is much variation among them.

5. *PARATHELYPTERIS* (H. Ito) Ching

Acta Phytotax. Sinica **8:** 300 (1963) p.p.; Holtt., Blumea **19:** 32 (1971).

Ching originally included in this genus a number of species which do not appear to me to be at all closely related to the designated type *Aspidium glanduligerum* Kunze (N.E. India to Japan). After removal of these alien species, the generic characters are: caudex a long-creeping slender rhizome; fronds rather small, with deeply pinnatifid pinnae and free veins; glands and slender septate hairs often present on lower surfaces; spores opaque with indistinct surface features and a slight irregular wing. The type species has basal pinnae not reduced, but two others have fronds long-decrescent at the base with very small basal pinnae; one of the latter is *Parathelypteris beddomei* (Bak.) Ching which occurs in South India and Ceylon (also on mountains in Malesia). A new species recently found in the island of Réunion agrees in habit with *P. beddomei* but has pinnae with wider lobes, no glands, and copious short hairs; in shape of pinnae and their indumentum the Réunion plant more nearly resembles a species from Brazil, *Thelypteris rivularioides* (Fée) Abbiatti. It is not clear to me whether this Brazilian species and its allies (which have not been recognized as a group) could be placed in *Parathelypteris*; if they were so placed, the genus would need re-defining. In the present uncertainty, the best course seems to be to describe the Réunion plant as a species of *Parathelypteris*, pointing out that a fuller understanding of it will probably involve the study of South American species. *Parathelypteris* agrees with *Amauropelta* in spores, so far as one can judge with the light microscope, but Amauropelta differs in having a rather massive erect caudex. *Amauropelta* species have a chromosome number 29; the number for *Parathelypteris beddomei* is 31.

1. **Parathelypteris salazica** Holtt., sp. nov.

Rhizoma longe repens, 2–2½ mm diametro, in sicco nigrum, stipites inter se 1–2 cm distantes ferens. Stipites 6 cm longi, basi nigri glabrique, sursum pallidi pilis patentibus 1½ mm longis vestiti; rachis similiter vestita. Lamina 40 cm vel ultra longa; pinnae usque 25-jugatae, inferiores 10-jugatae sensim reductae et remotiores, infimae c. 5 mm longae et latae. Pinnae maximae 4 cm longae, medio 1,0 cm latae, basi dilatata usque 1,5 cm latae, apice breviter acutae, ⅔ costam versus lobatae, lobis obliquis; costulae 4 mm inter se distantes; venae in lobis basalibus usque 6-jugatae, interdum furcatae, in lobis medialibus 4–5-jugatae simplices, venis infimis ad marginem supra basin sinus procurrentibus; rachis costaeque subtus pilis brunnescentibus 1½ mm longis conspersis pilisque brevibus multis vestitae; pagina inferior inter venas pilis erectis minutis praedita; costae supra breviter hirsutae, lamina omnino pilis minutis vestita. Sori submarginales; indusia pilis brevibus praedita.

Type: RÉUNION, Plaine des Salazes, 2 200 m; fissures humides (avec Spahgnum e Hépatiques), *Cadet 1981* bis (P).

6. *PSEUDOCYCLOSORUS* Ching

Acta Phytotax. Sinica **8:** 322 (1963).

Caudex erect or short-creeping; scales broad, thin, lacking superficial hairs. Fronds bipinnatifid with abrupt transition at the base to numerous small pinnae; aerophores, more or less swollen, present at the bases of at least the lower large and reduced pinnae; veins free, basal acroscopic vein of a group passing to base of a sinus between two pinna-lobes, basiscopic vein to edge above base of sinus; indumentum of acicular and short capitate hairs, variously distributed; sori indusiate; sporangia lacking hairs or glands near annulus, usually with a hair of 3 cells on their stalks, apical cell somewhat swollen; spores bearing numerous small isodiametric wings. Chromosome number: 35 and 36 both reported; further observations needed.

About 12 species, one widely distributed in Africa, two here described as new; the other species are on mainland tropical and subtropical Asia and Japan, one of them also in Luzon (northern island of the Philippines).

Reduced pinnae each consisting of a prominent aerophore, with no distinct lamina . . . . 1. *P. camerounensis.*

Reduced pinnae distinctly leafy:
  Basal acroscopic segment of lowest large pinna enlarged and deeply lobed; capitate hairs lacking on lower surfaces . . . . 2. *P. johannae.*
  Basal acroscopic segment of lower large pinnae not enlarged nor lobed; capitate hairs abundant all over lower surfaces, sometimes short acicular hairs also . . 3. *P. pulcher.*

1. **Pseudocyclosorus camerounensis** Holtt., sp. nov.

Caudex arborescens (collector); stipes fere ad basin pinnis multo reductis plurijugatis c. 3 cm inter se distantibus praeditus. Lamina 80 cm longa, pinnis 30-jugatis constituta; pinnae evolutae inferiores et pinnae reductae aerophoris tumidis praeditae. Pinnae maximae 20 × 2,4 cm, basi truncata acroscopice leviter auriculatae, basiscopice rotundatae, apice anguste acuminatae, usque alam 1½ mm latam lobatae; lobi falcati, acuti, pilis pallidis ciliati; costulae 4 mm inter se distantes; venae usque 15-jugatae, supra pallidae et prominentes; rachis subtus pilis sparsis pallidis praedita, costae pilis rigidis patentibus ½ mm longis vestitae, costulae minute pilosae, pagina inferior cetera glabra; costae costulaeque supra hirsutae, pagina superior cetera glabra. Sori mediales; indusia firma, glabra.

Type: CAMEROUN, Djuttitsa, 2 000 m, *Meurillon CNAC 726* (P; K !).

This species is closely allied to *Pseudocyclosorus tylodes* (Kunze) Ching of India and China, differing in the medal sori and conspicuously hairy lower surfaces of costae. It should be noted that the specific epithet *tylodes* was wrongly printed *xylodes* in the original description (published after Kunze's death); it is clear from other references in the text that *tylodes* was intended, and this spelling was accepted by Mettenius and Hooker.

2. **Pesudocyclosorus johannae** Holtt., sp. nov.

P. pulchro (Willd.) Holtt. affinis, differt: pinnis inferioribus basi acroscopice valde auriculatis, auriculis 2,5 cm vel ultra longis profunde lobatis, lobis 1 mm latis; pagina inferori rhachi, costarum costularumque pilis acicularibus solum vestita, pagina laminae inter venas glabra; indusia pilis brevibus acicularibus praedita.

Type: JOHANNA ISLAND, *C. W. Bewsher 24*, March 1877 (K!).

The type is somewhat smaller than the full development of *P. pulcher*; its largest pinna measures 20 × 2,2 cm. No other specimens are known to me.

3. **Pseudocyclosorus pulcher** (Bory ex Willd.) Holtt., comb. nov.—*Aspidium pulchrum* Bory ex Willd. in Linn. Sp. Pl. ed IV, **5:** 253 (1818).—*Nephrodium pulchrum* Desv., Mem. Soc. Linn. Paris **6:** 256 (1827).—*Lastrea pulchra* Presl, Tent. Pterid.: 75 (1836). Type: Réunion, *Bory 81* (*Herb. Willd. no. 19*, 787, B !).

Nephrodium longicuspe Bak. in Journ. Linn. Soc. Bot. **16:** 202 (1877).—*Aspidium longicuspe* Kuhn in v. Deck. Reisen 3 (3) Bot.: 65 (1879).—*Dryopteris longicuspis* C. Chr., Ind. Fil.: 275 (1905); Dansk. Bot. Ark. **7:** 46, pl. 9 fig. 13–18 (1932).—*Thelypteris longicuspis* Schelpe, Journ. S. Afr. Bot. **31:** 262 (1965); Fl. Zamb. Pterid.: 192 (1970).—*Lastrea longicuspis* Pic. Ser. in Webbia **23:** 175 (1968). Type: Madagascar, *H. Gilpin* (K !).

Nephrodium zambesiacum Bak. in Ann. Bot. **5:** 318 (1891).—*Aspidium zambesiacum* Hieron. in Engl. Pflanzenw. Ost. Afr. C: 85 (1895).—*Dryopteris zambesiaca* C. Chr., Ind. Fil.: 318 (1905).—*Thelypteris zambesiaca* Tard. in Notul. Syst. **14:** 345 (1952); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 278, fig. xxxix, 4–7 (1958). Type: Malawi, Shire Highlands, *Buchanan* (K !).

Dryopteris aequibasis C. Chr. in Bonap. Notes Pterid. **16:** 162 (1925).—*Thelypteris zambesiaca* var. *aequibasis* Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 280 (1958). Type: Madagascar, Tananarive, *Perrier 7580* (BM !).

Caudex erect; base of stipe to first large pinna 70 cm; reduced pinnae 3–5 cm apart, up to 10 pairs or more, lowest 3–5 mm long, uppermost 1,5 cm, deeply lobed; 1–2 pairs pinnae of intermediate size sometimes present; lowest large pinna gradually narrowed in basal 4–6 cm to a base 2 cm wide; aerophores swollen. Largest pinnae 20–28 cm long, 2,0–3,5 cm wide, base truncate but not or little auricled, apex caudate-acuminate (cauda 2,5 cm long), lobed to 1–1½ mm from costa, lobes hardly falcate, conspicuously fringed; costules to 4½ mm apart; veins to 18 pairs; lower surface of rachis and costae sparsely hairy, lower surface of costules, veins and lamina more or less copiously provided with short capitate hairs, sometimes with some acicular hairs; upper surface with or without short acicular and capitate hairs between veins. Sori medial; indusia firm, on the type covered with short capitate hairs only, acicular hairs present on some other specimens, capitate hairs in some cases few.

Distribution: Mauritius, Réunion, Madagascar, Malawi, Tanzania, Rhodesia, Uganda, Kenya, Ethiopia, Congo, Cameroons, Fernando Po.

Specimens from some parts of Africa have almost smooth indusia (capitate hairs very few); there is variability also in the abundance of capitate hairs on lower surface between veins. All Madagascan specimens at Kew, including the type of *Nephrodium longicuspe*, have rather small fronds (pinnae 15–20 cm long) and less abundant capitate hairs than the type of *C. pulcher*.

Dryopteris aequibasis C. Chr. was based on small specimens, probably from a young plant which have only one pair of reduced pinnae. Lower surfaces of rachis and costae are more copiously hairy than in larger specimens of *C. pulcher*; this might have been due to an exposed position. Sporangia are young, so spores cannot be seen.

7. *CHRISTELLA* Léveillé

Flore de Kouy-tchéou: 472 (1915); Holttum in Blumea **19:** 43 (1971).

In the paper of 1971 above cited, p. 45, I noted that certain free-veined species of tropical America appeared to belong to this genus, but I did not attempt to define their status. In the same year Dr Alan R. Smith published a detailed survey of these species (Univ. Calif. Publ. Bot. **59:** 1–136). Since 1971 I have come to realize that a group of African species are closely related to the American ones. These species differ from the type species of *Christella* (*C. parasitica*) in lacking elongate glandular hairs on the stalks of their sporangia, and in venation. They agree in the base chromosome number 36. I here propose for them the status of a new section of the genus *Christella*. The most important characters of the genus as a whole are: fronds bipinnatifid, always ± decrescent at base, rarely with an abrupt transition to much-reduced basal pinnae; indumentum of acicular and short capitate hairs, never sessile spherical glands; sporangia never with hairs or glands near the annulus; spores with rather slightly raised ridges or wings of irregular shape. The sections are thus distinguished:

Hair on sporangium stalk consisting of a single elongate glandular cell (similar glandular hairs present also on lamina in some species); veins always anastomosing (except in two species of the western Pacific); distribution mainly in the Old World . . . Sect. *Christella*
Elongate glandular hairs lacking from sporangium-stalks (acicular hairs sometimes present); veins all free, basal veins of adjacent groups connivent below the base of a sinus between two pinna-lobes, in some species sometimes united . . . . Sect. *Pelazoneuron*

SECT. CHRISTELLA

Pinnae crenate or shallowly lobed . . . . 1. *C. distans*
Pinnae lobed at least half way to costa:
Pinnae commonly at least 10 cm long; indusia hairy:
Basal pinnae deflexed but not reduced nor more widely spaced; large elongate orange glands on veins of lower surface . . . . 2. *C. parasitica*
Basal pinnae, usually 2–4 pairs, gradually reduced; glandular hairs, if any, small, capitate:
Fronds to 200 cm tall, largest pinnae 23–30 cm long . . . 3. *C. altissima*
Fronds and pinnae much smaller:
Caudex erect; pinnae lobed ¾ towards costa; basal veins anastomosing with a short excurrent vein to sinus, next veins to edge; some capitate hairs present . . . . 4. *C. hilsenbergii*
Caudex short-creeping; pinnae lobed less deeply; one or both second veins passing to sides of sinus-membrane; no capitate hairs . . 5. *C. dentata*
Pinnae to c. 3,5 cm long; indusia glabrous . . . . 6. *C. modesta.*

1. **Christella distans** (Hook.) Holtt., comb. nov.—*Nephrodium distans* Hook., Spec. Fil. **4:** 76 (1862).—*Aspidium distans* Kuhn, Fil. Afr.: 209 (1868), non Viviani 1825.—*Drypoteris distans* Kuntze, Rev. Gen. Pl. **2:** 812 (1891); C. Chr. in Dansk. Bot. Ark. **7:** 51 (1932).—*Cyclosorus distans* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 244 (1941); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 297 (1958).—*Thelypteris distans* Reed in Phytologia **17:** 276 (1968). Type: Madagascar, *Boivin* (K !).

Nephrodium eurostotrichum Bak. in Journ. Bot. **18:** 329 (1880).—*Dryopteris eurostotrichum* C. Chr., Ind. Fil.: 263 (1905). Type: Madagascar, *L. Kitching* (K !).

Caudex long-creeping; stipe to 30 cm; lamina to 60 cm long with 15 pairs pinnae, apex almost pinna-like, 1–3 pairs lower pinnae gradually smaller, lowest narrowed towards base on basiscopic side, ± auricled on acroscopic. Largest pinnae 12 × 2,2 cm, widest at truncate base, tapering rather evenly, edges crenate to depth of 2–3 mm; costules 3½ mm apart; veins to 9 pairs, 2–2½ pairs anastomosing, 2 pairs to sides of membrane; lower surface of costae rather long-hairy, shorter hairs on costules, veins and lamina; upper surface with scattered stiff hairs on costules like those on costae, few other hairs. Sori inframedial; indusium large, with short hairs.

Distribution: Madagascar and Comoro Islands.

2. **Christella parasitica** (L.) Lév., Fl. Kouy-tcheou: 475 (1915).—*Polypodium parasiticum* L., Sp. Pl.: 1090 (1753); C. Chr. in Ark. for Bot. **9**, no. 11: 26, f. 4 (1910).—*Aspidium parasiticum* Sw. in Schrad. Journ. Bot. 1800 **(2):** 35 (1801).—

Nephrodium parasiticum Desv. in Mem. Soc. Linn. Paris **6:** 260 (1827).—*Dryopteris parasitica* Kuntze, Rev. Gen. Pl. **2:** 811 (1891); C. Chr., Ind. Fil.: 282, p.p. (1905).—*Cyclosorus parasiticus* Farw. in Amer. Midl. Nat. **12:** 259 (1931); Holtt., Rev. Fl. Malaya **2:** 281, fig. 162 (1955).—*Thelypteris parasitica* Fosberg, Occ. Pap. Bishop Mus. **23:** 30 (1962). Type: Canton, *Osbeck* (in Herb. Sw., S-PA).

Nephrodium didymosorum Parish ex Bedd., Ferns Br. India: t. 200 (1866).—*Dryopteris didymosora* C. Chr., Ind. Fil.: 262 (1905). Type: Moulmein, *Parish* (not seen).

Nephrodium tectum Wall. ex Bedd., Handb. Ferns Br. India Suppl.: 79 (1892). Type: India, *Wallich 394* (K !).

Thelypteris fadenii Fosberg & Sachet in Smiths. Contr., Bot. **8:** 9 (1972). Type: Uganda, Kampala, *K. A. Lyne 5186* (MHU; US, K !, P !).

Caudex short-creeping; stipes to c. 40 cm long, bearing slender spreading hairs; lamina to 40–50 cm long, texture thin; lower pinnae deflexed but not reduced nor more widely spaced, auricled at acroscopic base. Largest pinnae 12 × 2 cm, short-acuminate, lobed $\frac{2}{3}$–$\frac{3}{4}$ towards costa, lobes slightly oblique; costules 4 mm apart; veins 8–10 pairs, lowest anastomosing with short excurrent vein to sinus, next to edge; lower surfaces generally covered with slender spreading hairs to 1 mm long, thick orange glandular hairs scattered on costules and veins in lobes; upper surface of costae antrorse-hairy, scattered long hairs on veins, very short hairs between veins. Distal sori medial, lower ones divergent, lowest sometimes touching; indusia hairy.

Distribution: widely in tropical Asia and the Pacific; in Africa apparently only known from Uganda.

This species has been much confused with *C. dentata*. There appears to be variation in the length of the creeping caudex, also in the abundance of the glandular hairs on the lower surface; these hairs are more abundant on the type of *Thelypteris fadenii* than is usual in this species in Asia. Manton and Sledge report that *C. parasitica* in Ceylon is tetraploid (Phil. Trans. R. Soc. B, **238:** 138. 1954). Possibly the plant described as *T. fadenii* in Uganda is a tetraploid of origin different from the Ceylon plant.

3. **Christella altissima** Holtt., sp. nov.

Caudex longe repens, 1 cm diametro; stipes 40 cm longus, breviter pilosus paleis 10 × $1\frac{1}{2}$ mm onustus; lamina usque 200 cm longa, pinnis inferioribus 6-jugatis vel pluribus sensim reductis, majoribus valde auriculatis, auricula acuminata, profunde lobata; pinnae maximae 28–34 cm longae, 2.5–3.5 cm latae, basi subtruncatae, anguste acuminatae, $\frac{2}{3}$–$\frac{3}{4}$ costam versus lobatae, lobis falcatis obtusis; costulae $4\frac{1}{2}$–$5\frac{1}{2}$ mm inter se distantes; venae 11–15-jugatae, $1\frac{1}{2}$-jugatis anastomosantibus, 1-jugatis membranam sinus tegentibus; pagina inferior omnino pilis patentibus $\frac{1}{3}$–$\frac{1}{2}$ mm longis vestita; costa supra pilis $\frac{2}{3}$ mm longis vestita, costulae venaeque pilis aequilongis conspersis praeditae, lamina inter venas pilis suberectis $\frac{1}{3}$ mm longis praedita. Sori mediales, inferiores supramediales, infimi non coalescentes; stipituli sporangiorum pilis unicellularibus elongatis vel glanduliformibus vel acicularibus praediti; sporae (semper?) abortivae.

Type: NATAL, in a bog, *Buchanan 103b* (K !); also at K, similar *Buchanan 8,186.*

This differs from the Natal plants of *C. dentata* in its much larger size, more veins anastomosing, and in the presence of long acicular hairs on the stalks of many sporangia. *Buchanan 8* is one of the specimens cited by Schelpe under *Thelypteris dentata* var. *buchanani* (Journ. S. Afr. Bot. **31:** 265, fig. 1d; 1965) but the type of that variety has pinnae much less deeply lobed, and I judge it to be a possible hybrid between *Pneumatopteris afra* and *Christella dentata.*

4. **Christella hilsenbergii** (Presl) Holtt., comb. nov.—*Nephrodium hilsenbergii* Presl, Epim. Bot.: 47 (1851). Type: Mauritius, *Sieber 49* (PRC, P ! K !).

Nephrodium quadrangulare Fée, Gen. Fil.: 308 (1852).—*Dryopteris quadrangularis* Alston in Journ. Bot. **75:** 253 (1937).—*Cyclosorus quadrangularis* Tard. in Notul. Syst. **14:** 345 (1952).—*Thelypteris quadrangularis* Schelpe in Journ. S. Afr. Bot. **30:** 196, t. 1 fig. b (1964); Fl. Zamb. Pterid.: 195 (1970); A. R. Smith in Univ. Cal. Publ. Bot. **59:** 64, fig. 114 (1971). Type: Guyana, *Leprieur 182* (P?, NY).

Dryopteris contigua Rosenst. in Meded. Rijksherb. Leiden no. **31:** 8 (1917). —*Cyclosorus contiguus* Copel., Gen. Fil.: 142 (1947).—*Thelypteris contigua* Reed in Phytologia **17:** 269 (1968). Type: Borneo, *Teuscher* (L !).

Caudex erect; stipes c. 30 cm long; lamina 30–40 cm long, softly herbaceous, pinnae usually rather close, middle ones at right angles to rachis, lower 2–4 pairs ± reduced and deflexed but not much more widely spaced, several pairs lower pinnae with enlarged and ± crenate basal acroscopic segment. Largest pinnae commonly 8–12 × 1,2–1,5 cm (to 14 × 1,9 cm), acuminate, lobed at least $\frac{3}{4}$ towards costa (to 1–2 mm from costa), lobes slightly oblique, slightly falcate, ends rounded; costules 3–3$\frac{1}{2}$ mm apart; veins 7–8 pairs; all lower surfaces covered with slender spreading hairs to 1 mm long, some capitate hairs, sometimes orange, on costules; slender ± appressed hairs on and between veins of upper surface throughout, sometimes also capitate hairs, in addition to longer ones on costae and costules. Sori usually a little inframedial; indusium bearing hairs $\frac{1}{2}$ mm long in middle.

Distribution: Mauritius, Réunion, Madagascar, Seychelles; Mozambique, Malawi, Rhodesia, Kenya, Tanzania, Sudan, Nigeria, Ghana, Ivory Coast, Fernando Po; also widely in tropical Asia and tropical America.

Plants of this species have been recorded as diploid in Nigeria, Ghana, Ceylon and Florida. For references to distribution in the Americas, see A. R. Smith l.c. 1971. There are local varieties of this species, those in America characterized and named by A. R. Smith. Specimens from the Seychelles differ from the Mauritius type in lower surface and indusia less hairy and rather supramedial sori. Those in Ceylon and Malesia have shorter middle pinnae and more decrescent basal ones, with local differences in pubescence.

5. **Christella dentata** (Forsk.) Holtt., comb. nov.—*Polypodium dentatum* Forsk., Fl. Aegypt. Arab.: 185 (1775).—*Dryopteris dentata* C. Chr. in K. Dansk. Vid. Selsk. Skr. Afd. VIII, **6:** 24 (1920).—*Thelypteris dentata* E. St John in Amer. Fern Journ. **26:** 44 (1936); Schelpe, Fl. Zamb. Pterid.: 97 (1970); A. R. Smith in Univ. Cal. Publ. Bot. **59:** 57 (1971).—*Cyclosorus dentatus* Ching in Bull. Fan Mem. Inst. Biol. Bot. **8:** 206 (1938); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 290 (1958). Type: Yemen, *Forskal* (C).

Aspidium aquapimense Schum. in K. Dansk. Vid. Selsk. Skr. Afr. **4:** 230 (1829). Type: Guinea, *Thonning* (C).

Aspidium violascens Link, Hort. Berol. **2:** 115 (1833); Mett., Fl. Hort. Lips: 91 (1856)—*Nephrodium violascens* Fée, Gen. Fil.: 305 (1852). Type: cult. Hort. Berol. (B !).

Nephrodium hispidulum A. Peter in Fedde Repert. Beih. 40, **1:** 58, Descr. 10, t.4 a,b (1920). Type: Rhodesia, *A. Peter* (B).

Cyclosorus subpubescens sensu Holtt., Rev. Fl. Malaya **2:** 273, 624, fig. 157 (1955), non Bl.

Caudex short-creeping, size of fronds very variable according to situation; stipes to 50 cm; frond to 90 cm long, lower 2–4 pairs pinnae gradually smaller, more widely spaced, with enlarged crenate basal acroscopic lobes. Largest pinnae to 15 × 2,5 cm, lobed a little over ½ way to costa; costules 3½–4 mm apart; veins 8–9 pairs, lowest pair anastomosing with excurrent vein to sinus, one or both of next pair to sides of membrane; lower surface of rachis and costae bearing erect hairs ⅓ mm long, shorter hairs on costules, veins and surface; upper surface with long hairs on costa and scattered on costules and veins, minute hairs between veins. Sori medial; indusia short-hairy.

Distribution: throughout tropics of Old World, adventive in some parts of tropical America.

This species has been shown to be tetraploid in Ceylon, and is everywhere variable. It grows in somewhat open places and has followed the destruction of forest by man. Local cytotaxonomic studies will probably reveal the existence of hybrids (see Ghatak, Manton & Holttum, British Fern Gazette **10:** 183–192, 1971).

Dryopteris parasitica var. *coriacea* Bonap., Notes Pterid. 5: 81 (1917) was based on a Madagascan specimen described simply as unusually coriaceous (*Viguier & Humbert 664*, P !). Apart from their coriaceous texture the fronds, in my judgement, are not distinguishable from *Christella dentata*. Christensen wrote on the herbarium sheet "perhaps *D. mauritiana* forma", but sporangia are unlike those of *D. mauritiana* (*Spaerostephanos elatus* of the present paper).

6. **Christella modesta** Holtt. sp. nov.

Caudex brevis, erectus (?); stipes usque 7 cm longus, stramineus; lamina usque 16 cm longa, anguste acuminata, pinnis c. 10–jugatis constituta, pinnis infimis reductis; pinnae infimae 10–14 mm longae, basi basiscopice angustatae acroscopice non auriculatae; pinnae maximae 3,3 × 0,7 cm, breviter acuminatae, dimidio costam versus lobatae, lobis obliquis ciliatis vix falcatis; costulae 2½ mm inter se distantes; venae 3–4-jugatae, infimae sub angulo acuto anastomosantes vel interdum ad basin sinus conniventes; rachis, costae, costulaeque subtus pilis rigidis ⅕–⅓ mm longis sparsim vestitae, pagina inferior cetera glabra; costae costulae venaeque supra pilis rigidis sparsis praeditae. Sori mediales, indusia glabra.

Type: MADAGASCAR, Zahamena (Réserve naturelle no. 3), *R. Decary 16,485* (P!).

The spores of this plant agree with *Christella*, but the sporangia appear to lack glandular hairs on their stalks. No other species of sect. *Christella* has glabrous indusia.

SECT. PELAZONEURON, Holtt., Sect. nov.

Venae infimae acroscopicae ad basin sinuum procurrentes, basiscopicae vel cum acroscopicis conniventes vel ad marginem prope bases sinuum procurrentes; raro venae ambae infimae sub sinu anastomosantes; stipites sporangiorum glandulas elongatas non ferentes.

Type species: *Polypodium patens* Sw., Nov. Gen. et Sp. Pl. Prodr.: 133 (1788).

1–6 pairs very small reduced pinnae at base of frond; costules 2½–3 mm apart:
Frond c. 30 cm long excluding reduced pinnae; lamina between veins on both surfaces glabrous . . . . 7. *C. guineensis*
Frond c. 50–60 cm long excluding reduced pinnae; lamina between veins of lower surface bearing acicular and capitate hairs . . . . 8. *C. friesii*
One or more pairs lower pinnae gradually reduced; costules 3–4 mm or more apart;
Pinnae to 4 × 1 cm . . . . 9. *C. multifrons*
Pinnae much larger:
Largest pinnae bearing separately adnate pinnules near their bases . 10. *C. afzelii*
Largest pinnae pinnatifid, no free pinnules:
Pinnae lobed to 3½ mm from costa; indusia glabrous . . . 11. *C. callensii*
Pinnae lobed more deeply; indusia bearing capitate and/or acicular hairs:
Indusia and lower surfaces generally bearing copious ± yellow capitate hairs and a few short acicular hairs . . . . 12. *C. microbasis*

Indusia and lower surfaces bearing more acicular than capitate hairs:
  Pinnae lobed to 1–1½ mm from costa; upper surface between veins bearing short acicular hairs:
    Caudex erect . . . . 13. *C. gueintziana*
    Caudex decumbent . . . . 14. *C. chaseana*
  Pinnae lobed to 2–2½ mm from costa; upper surface between veins glabrous or nearly so . . . . 15. *Dryopteris pseudogueintziana.*

7. **Christella guineensis** (Chr.) Holtt., comb. nov.—*Dryopteris guineensis* Chr. in Journ. de Bot. **22:** 22 (1909).—*Thelypteris guineensis* Alston in Bull. Brit. Mus. (Nat. Hist.) Bot. **1:** 48 (1952); Ferns W. Trop. Afr.: 61 (1959). Type: Guinea, Labé, *Chevalier 12, 385* (P !).

Caudex short-creeping; stipe to 30 cm, stramineous, minutely hairy; lamina 30–45 cm long, at base abruptly reduced to 1–4 pairs pinnae c. 1 cm long or less. Largest pinnae to 10,5 × 1,6 cm, base not auricled, acuminate, lobed to less than 1 mm from costa; lobes slightly falcate, tips rounded with an apiculus; costules 2½ mm apart; veins 9–10 pairs; lower surface of costae and costules with sparse spreading hairs to ½ mm long, few on costules, a few capitate hairs on costules, no others; upper surface hairy on costa, sparse hairs on costules and veins, not between veins. Sori medial; indusia small, bearing short capitate hairs only.

Distribution: Sierra Leone, Guinea, Nigeria.

8. **Christella friesii** (Brause) Holtt., comb. nov.—*Dryopteris friesii* Brause in R. E. Fries, Wiss. Ergebn. Schwed. Rhod.-Kongo Exp. Bot. **1:** 1 (1914).—*Thelypteris friesii* Schelpe in Bol. Soc. Brot. Ser. 2, **41:** 216 (1967); Fl. Zamb. Pterid.: 192 (1970). Type: Zambia, Luvingo, *R. E. Fries 1104* (UPS).

Caudex short-creeping; stipe 30 cm or more long, pale, short-hairy in groove; lamina to c. 70 cm long, basal 5–6 pairs of pinnae much reduced, some lower large pinnae deflexed. Largest pinnae 10–16 × 1,7–2,0 cm, base truncate, apex acuminate, lobed to less than 1 mm from costa; costules 2½–3 mm apart; veins 8–12 pairs; lower surface of rachis, costae, costules and veins bearing slender spreading pale hairs, on lamina between veins slender erect acicular and short capitate hairs; upper surface hairy on costa, sparsely on costules and veins, very short hairs also on and between veins. Sori small, medial; indusia small, bearing acicular and capitate hairs.

Distribution: Congo, Cameroons, Tanzania, Kenya, Zambia, Malawi, Rhodesia.

9. **Christella multifrons** (C. Chr.) Holtt., comb. nov.—*Dryopteris multifrons* C. Chr. in Bonap. Notes Pterid. **16:** 172, Pl. IIB (1915); Dansk. Bot. Ark. **7:** 47 (1932).—*Thelypteris multifrons* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 252 (1941); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 281, fig. xl, 1–3 (1958). Type: Madagascar, *Perrier 11, 538* (P !).

Caudex short-creeping; stipes 25–35 cm long, stramineous; lamina 30 cm long, pinnae 8–12 pairs, 2½–3 cm apart; lower pinnae slightly shorter and more widely spaced. Largest pinnae 3,7 × 0,8–1,0 cm; base broadly unequally cuneate (basal acroscopic segment 7 mm long, basiscopic 5 mm), short-acuminate, lobed to 1 mm from costa, basal acroscopic lobe sometimes almost free; lobes oblique, separated by rounded sinuses where fertile; costules 4 mm apart; veins 3–4 pairs (5 pairs in basal acroscopic lobe); lower surface of rachis, costae and costules rather sparsely short-hairy, sparse short erect hairs between veins; upper surface hairy on costa, hairs on costules and veins few, short. Sori a little inframedial; indusia rather large, short-hairy.

Only known from type collection.

10. **Christella afzelii** (C. Chr.) Holtt., comb. nov.—*Dryopteris afzelii* C. Chr. in Ark. for Bot. 14, no. **19:** 2, pl. 1 (1916); Dansk. Bot. Ark. **7:** 47, pl. 11, fig. 1–4 (1932).—*Thelypteris afzelii* Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 282 (1958). Type: Madagascar, *Afzelius & Palm 480* (P !).

Caudex short-creeping; stipe 40 cm; lamina 40–60 cm long, middle pinnae 3½ cm apart, lower somewhat reduced and to 7 cm apart. Largest pinnae 12 × 1,5–2,5 cm, costa bearing up to 7 pairs free adnate segments in basal part, a pinnatifid lamina distally; veins in free segments to 9 pairs, some forked; lower surface of rachis and costae bearing spreading hairs, hairs on costules shorter, ± antrorse, slender erect hairs on surface between veins; upper surface hairy on costa, scattered long hairs on costules and veins. Sori medial, sometimes on both branches of lower veins; indusia short-hairy.

Distribution: Madagascar, known from two collections.

11. **Christella callensii** (Alston) Holtt., comb. nov.—*Cyclosorus callensii* Alston in Bol. Soc. Brot. Ser. 2, **30:** 13 (1956).—*Thelypteris callensii* Reed in Phytologia **17:** 266 (1968). Type Congo, Zongo, *Callens 2861* (BM !).

Stipe 20 cm long, densely covered with hairs 1 mm long; lamina 35 cm long, pinnae 16 pairs, basal pinnae slightly reduced, narrowed in basal 1½ cm. Largest pinnae 9 × 1,7 cm, base truncate, acuminate, lobed to 3½ mm from costa; lobes hardly falcate; costules 4–4½ mm apart, at wide angle to costa; veins 7 pairs; lower surface of rachis densely hairy, costae and costules with scattered pale hairs over ½ mm long and shorter ones, short hairs on veins; copious long pale hairs on upper surface of costae and costules and sparsely on veins. Sori medial, indusia large, glabrous.

Only known from type collection, found among rocks near a waterfall.

12. **Christella microbasis** (Bak.) Holtt., comb. nov.—*Nephrodium microbasis* Bak., Syn. Fil. ed. 2: 496 (1874).—*Dryopteris microbasis* Kuntze, Rev. Gen. Pl. **2:** 813 (1891).—*Thelypteris microbasis* Tard. in Mem. Inst. Fran. Afr. Noire

28: 117, t. 20 f. 1 (1953); Alston, Ferns W. Trop. Afr.: 61, 80 (1959).—*Lastrea microbasis* Pic. Serm. in Webbia **23:** 175 (1968). Type: Nigeria, *Barter* (K !).

Dryopteris adenochlamys C. Chr. in Fedde Repert. 9: 370 (1911). Type: Guinea, Fouta Djallon, *Pobéquin 9* (P !).

Caudex short-decumbent; stipe 50–60 cm long, stramineous; lamina 50–60 cm long, 2–3 pairs basal pinnae reduced, lowest 2,5 cm long. Largest pinnae 12 × 1,8 cm (fertile a little narrower), basal acroscopic segment somewhat elongate and widened, sometimes crenate; apex acuminate; lobed to 1 mm from costa; costules 3–4 mm apart; veins 8–10 pairs; lower surface of rachis, costae, costules and veins bearing hairs on varying length, to 1 mm long, on all parts of lower surface abundant short capitate hairs, often yellowish; long hairs abundant on costae of upper surface, scattered on costules and veins, a few acicular and capitate hairs between veins. Sori a little supramedial; indusia bearing copious short capitate hairs and a few acicular hairs.

Distribution: Guinea, Ivory Coast, Sierra Leone, Nigeria, Mali, Angola; single specimens from Kenya and Tanzania differ in presence of many anastomosing basal veins. A plant examined cytologically by Manton was tetraploid (see Alston, 1959: 80).

13. **Christella gueinziana** (Mett.) Holtt., comb. nov.—*Aspidium gueintzianum* Mett., Farngatt. IV: 83 (1858).—*Lastrea gueintziana* Moore, Ind. Fil.: 93 (1858). —*Nephrodium gueintzianum* Hieron. in Engl. Bot. Jahrb. **28:** 341 (1900).—*Dryopteris gueintziana* C. Chr., Ind. Fil.: 269 (1905).—*Thelypteris gueinziana* Schelpe in Journ. S. Afr. Bot. **31:** 262, 264 (1965); Fl. Zamb. Pterid.: 194 (1970). Type: Natal, *Gueinzius* (B).

Dryopteris prolixa sensu C. Chr., Dansk. Bot. Ark. **7:** 45 (1932); *Thelypteris prolixa* sensu Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 280, fig. xxxix, 8–10 (1958); not *Aspidium prolixum* Willd.

Caudex erect; stipe to 30 cm, stramineous, basal scales to 4 mm long; lamina 60–90 cm long, 1 or more pairs lower pinnae gradually reduced, deflexed and auricled. Largest pinnae commonly 12 × 1,8 cm (exceptionally to 20 × 2,4 cm), auricled at acroscopic base, auricle crenate or lobed; narrowly acuminate; lobed to 1½ mm from costa, lobes falcate; costules commonly 4 mm apart; veins 8–10 (-15) pairs; lower surface of rachis, costae, costules and veins bearing short spreading acicular hairs, short capitate hairs also present on all parts; upper surface hairy on costae, sparsely on costules, with short stiff suberect hairs between veins. Sori medial; indusia bearing both short acicular and capitate hairs.

Distribution: Madagascar, S. Africa, Mozambique, Rhodesia, Malawi, Tanzania, Kenya, Ethiopia, Sudan, Angola. Specimens from St Helena, lacking caudex, belong to this species or to *C. chaseana*.

14. **Christella chaseana** (Schelpe) Holtt., comb. nov.—*Thelypteris chaseana* Schelpe in Journ. S. Afr. Bot. **31:** 263 (1965); Fl. Zamb. Pterid.: 194 (1970).—*Lastrea chaseana* Pic. Serm. in Webbia **23:** 175 (1968). Type: S. W. Africa, Otjiwarongo Distr., *Schelpe 4791* (BOL).

Caudex creeping; stipes to 60 cm long, basal scales to 11 mm long; lamina much as in *C. gueintziana*, but sterile pinnae sometimes lobed less deeply with basal veins sometimes anastomosing below the sinus.

Distribution: S.W. Africa, Angola, Congo, W. Cameroons, Uganda, Kenya, Tanzania, Malawi, Zambia, Rhodesia.

This species is very near *Thelypteris conspersa* (Schrad.) A. R. Smith in Univ. Cal. Publ. Bot. **59:** 60 (1971) of South America.

15. **Dryopteris pseudogueintziana** Bonap. in Bull. Jard. Bot. Brux. **4:** 4 (1913). —*Thelypteris pseudogueintziana* Alston, Ferns W. Trop. Afr.: 61 (1959) excl. syn. *Dryopteris membranifera* C. Chr. Type: Congo, Kitobola, *A. Flamigni* (P !).

Caudex erect or suberect with tufted fronds; stipe 25 cm long, lamina 50 cm long, pinnae 20 pairs; lowest pair pinnae 5 and 7½ cm long, deflexed, shortly auricled on acroscopic side, auricle crenate or not. Largest pinnae 11,5 × 1,8 cm, lobed to 2–2½ mm from costa; costules to 4 mm apart; veins 9–10 pairs, no anastomosis of basal veins observed; lower surfaces of rachis, costae and costules bearing minute acicular and a few short capitate hairs, none between veins; hairs on upper surface of costa more that ½ mm long, scattered also on costules and veins, hairs between veins few. Sori a little supramedial; indusia with a few short acicular and some capitate hairs.

Only known from type collection, above described; differs from *C. gueintziana* in less deeply lobed pinnae, shorter and more sparse pubescence on both sides and doubtfully in supramedial sori. These differences might be due to an unusually shady environment.

8. *STEGNOGRAMMA* Blume

Enum. Pl. Jav.: 172 (1828), emend. K. Iwatsuki, in Acta Phytotax. Geobot. **19:** 112–126 (1963).

Caudex short-creeping or erect; stipes densely hairy, hairs unicellular or septate (unicellular in African species); fronds simply pinnate, basal pinnae not or little reduced; spherical glands lacking; veins free or with goniopteroid anastomosis; sori exindusiate, running along veins; sporangia copiously setiferous; spores with many small wings; chromosome number 36.

About 15 species, throughout warmer parts of the Old World, with a few (not yet clearly distinguished) in tropical America. Iwatsuki has united here *Leptogramma* J. Sm. and *Dictyocline* Moore; the arrangement appears to be a natural one.

1. **Stegnogramma pozoi** (Lagasca) K. Iwats. in Acta Phytotax. Geobot. **19:** 124 (1963).—*Hemionitis pozoi* Lagasca, Nov. Gen. Sp.: 33 (1816).—*Gymnogramme pozoi* Desv. in Mem. Soc. Linn. Paris **6:** 216 (1827)—*Pleurosorus pozoi* Trevisan in Atti Soc. Ital. Sci. Nat. **17:** 256 (1875).—*Ceterach pozoi* A. Braun ex Milde in Bot. Zeit. **24:** 310 (1866).—*Thelypteris pozoi* Morton in Bull. Soc. Bot. France **106:** 234 (1959); Schelpe, Fl. Zamb. Pterid.: 199 (1970).—*Leptogramma pozoi* Heywood in Fedde Repert. **64:** 19 (1961). Type: Northern Spain, *D. G. del Pozo* (S-PA).

Polypodium tottum Willd. in Linn. Sp. Pl. ed. IV, **5:** 201 (1810), non Thunb. 1800.—*P. africanum* Desv. in Mem. Soc. Linn. Paris **6:** 239 (1827), nom. nov.—*Dryopteris africana* C. Chr., Ind. Fil.: 250, p.p. (1905); Sim, Ferns S. Afr. ed. 2: 25, pl. 23 (1915).—*Lastrea africana* Ching in Contr. Biol. Lab. Sci. Soc. China **9:** 36 (1933).—*Leptogramma africana* Nakai ex Mori, Enum. Pl. Corea: 13 (1922).—*Lastrea africana* Copel., Gen. Fil.: 138 (1947). Type: South Africa, *Herb. Willd. no. 19, 697* (B !).

Gymnogramma totta Schlechtend., Adumbr. Fil. Prom. B. Spei: 15, t. 6 (1825).—*Grammitis totta* Presl, Tent. Pterid.: 209 (1836).—*Leptogramma totta* J. Sm. in Hook. J. Bot. 4: 52 (1841).—*Phegopteris totta* Mett., Farngatt. IV: 18 (1858).—*Aspidium tottum* Engl., Hochgebirgsfl. Trop. Afr. (1892) 99.—*Nephrodium tottum* Diels in Engl. & Prantl, Nat. Pflanz. fam. 1, Abt. 4: 170 (1899).—*Dryopteris totta* Masum. in Mem. Fac. Sci. Agric. Taihoku Univ. **11:** 58 (1934).—*Lastrea totta* Ohwi in Bull. Nat. Sct. Mus. Tokyo **3:** 98 (1934). Type: Cape Peninsula (HAL).

Acrostichum pilosiusculum Wikstr. in K. Vet. Acad. Handl. 1825: 439 (1826).—*Leptogramma pilosiuscula* Alston in Bol. Soc. Brot. Ser. 2, **30:** 17 (1956); Ferns W. Trop. Afr.: 63 (1959). Type: Madeira, *Masson* (BM).

Gymnogramma lowei Hook. & Grev., Ic. Fil.: t. 89 (1829). Type: Madeira, *Lowe* (E).

Caudex short, erect; stipe to 25 cm long, stramineous, basal scales thin and densely hairy; lamina 25–45 cm long, several pairs upper pinnae adnate to rachis; basal pinnae somewhat reduced, narrowed towards base especially on basiscopic side. Largest pinnae 6 × 1,5 to 12 × 2,5 cm, base truncate, not dilated, apex short-acuminate, lobed to 2–3 mm from costa; costules 4–6 mm apart; veins 6–8 pairs, usually simple, basal acroscopic vein to side of sinus-membrane, basiscopic to edge; lower surface of rachis, costae and costules bearing stiff pale hairs to 1 mm long, shorter hairs on veins; appressed slender hairs to $\frac{1}{2}$ mm long all over upper surface. Sori occupying middle part of each vein, c. 2 mm long; sporangia setose.

Distribution: northern Spain, Madeira, Azores, widely in tropical Africa, South Africa, Comoro Islands. Plants in the region India to Japan have been regarded by Ching as representing a distinct species, by Iwatsuki (l.c. 1963, p. 125) as *S. pozoi* subsp. *mollissima* (Fischer ex Kunze) K. Iwats.

9. *THELYPTERIS* Schmidel
Ic. Pl. ed. Keller: 45, t. 11, 13 (1763).

Rhizome slender, growing in wet ground, branching, fronds widely spaced; scales broad, thin, not hairy; lamina bipinnatifid, basal pinnae not or little reduced; veins all free, often forked, running to margin; flat thin scales present on lower surface of costae (also filamentous smaller ones); unicellular acicular and capitate hairs sometimes present on lamina but not sessile spherical glands; sori indusiate; short capitate hairs sometimes present on sporangia (not seen on African species); spores with irregularly spiny exine and no perine. Chromosome number 35.

Two or three species; one or two in north temperate regions, one in isolated areas mostly south of the equator.

1. **Thelypteris confluens** (Thunb.) Morton in Contr. U.S. Nat. Herb. **38:** 71 (1967); Schelpe, Fl. Zamb. Pterid.: 190, tab. 55E (1970).—*Pteris confluens* Thunb., Prodr. Fl. Cap.: 171 (1800). Type: S. Africa, *Thunberg* (UPS).

Aspidium thelypteris var. *squamigerum* Schlechtend., Adumb. Fil. Prom. B. Spei: 23, t. 11 (1825).—*Aspidium squamigerum* Fée, Mem. Fam. Foug. **8:** 104 (1857).—*Lastrea thelypteris* var. *squamigera* Bedd., Handb. Ferns Br. India Suppl.: 54 (1892).—*Dryropteris thelypteris* var. *squamigera* C. Chr., Ind. Fil.: 297 (1905).—*Thelypteris palustris* var. *squamigera* Weath. in Contr. Gray Herb. n.s. **73:** 40 (1924).—*Thelypteris squamigera* (err. typ. *squamulosa*) Ching in Bull. Fan Mem. Inst. Biol. Bot. **6:** 329 (1936); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 282 (1958). Type: Cape Peninsula (HAL).

Nephrodium squamulosum Hook. f., Fl. New Zeal. **2:** 39 (1855).—*Nephrodium thelypteris* var. *squamulosum* Hook., Spec. Fil. **4:** 88 (1862). Type: New Zealand, *Colenso* (K !).

Lastrea fairbankii Bedd., Ferns Br. India: t. 254 (1867); Handb. 240 (1883). Type: Pulney Hills, S. India, *Beddome* (K !).

Rhizome 2 mm diameter; stipe stramineous, 15–50 cm long; lamina 25–50 cm long, pinnae to 20 or more pairs, dimorphous; sterile pinnae to 15 mm or more wide, fertile commonly 6–9 mm wide; lowest pinnae slightly reduced, sometimes with free basal acroscopic segment; middle pinnae not dilated at base, lobed to less than 1 mm from costa; veins in sterile fronds mostly forked, in fertile sometimes simple; lower surface of costae bearing slender hairs and ovate-orbicular flat scales with short hairs on edges; lower surface of lamina bearing a variable number of slender acicular and/or short capitate hairs; upper surface short-hairy on costa. Sori near costules; indusia bearing short hairs on edges.

Distribution: Madagascar, Africa south of the equator and to 7° N. in Ethiopia and Sudan; S. India, N. Thailand, Sumatra, New Guinea, New Zealand.

10. *CYCLOSORUS* Link

Hort. Berol. **2:** 128 (1833); Holttum in Blumea **19:** 27 (1971).

Similar to *Thelypteris* in long-creeping rhizome growing in wet ground, lower pinnae not reduced, flat scales on lower surface of costae and in spores; differing in anastomosing veins, in presence of spherical glandular cells at ends of hairs on stalks of sporangia and often on lower surface of lamina, and in chromosome number 36.

This genus, as above restricted, is pantropic in distribution (and extra-tropical in southern hemisphere); it comprises a complex of forms the inter-relationships of which cannot be established without extensive cytotaxonomic investigation. For convenience, three species are here recognized, but intermediates exist. The synonymy is complex, and without a guide from experimental work much of it is uncertain. It is thus here reduced to a minimum, but attention must be called to the fact that many other binomials have been published, based on specimens from many parts of the world. Apart from *C. striatus*, peculiar to Africa, the name *Cyclosorus gongylodes* (Schkuhr) Link has been applied in recent years by most authors to all specimens; recently the situation has been complicated by the discovery of first one and than another earlier name. In the 19th century the name *Nephrodium unitum* was commonly used, based on *Polypodium unitum* Linn. because at least one reference cited by Linnaeus certainly referred to a plant of *Cyclosorus* in the present sense, but the Linnean type represents the species described in the present paper as *Sphaerostephanos unitus*.

Pinnae lobed ¾ or more towards costa, commonly 2½–3 cm wide; lower surface of costules bearing abundant very small scales . . . . 1. *C. striatus*
Pinnae lobed less deeply, rarely to 2 cm wide; lower surface of costules glabrous or bearing acicular and/or capitate hairs, often also spherical glands:
    Pinnae quite hairless and eglandular beneath, very firm . . . . 2. *C. tottus*
    Pinnae variously hairy and glandular beneath, usually thinner 3. *C. interruptus*

1. **Cyclosorus striatus** (Schum.) Ching in Bull. Fam. Mem. Inst. Biol. Bot. **10:** 249 (1941); Alston, Ferns W. Trop. Afr.: **62** (1959).—*Aspidium striatum* Schum. in K. Dansk. Vidensk. Selsk. **4:** 230 (1829).—*Dryopteris striata* C. Chr., Ind. Fil.: 294 (1905).—*Thelypteris striata* Schelpe in Journ. S. Afr. Bot. **31:** 268 (1965); Fl. Zamb. Pterid.: 199 (1970). Type: Guinea (C).

Polypodium pallidivenium Hook., Spec. Fil. **5:** 8 (1863).—*Nephrodium pallidivenium* Bak., Syn. Fil.: 290 (1867).—*Dryopteris pallidivenia* Kuntze, Rev. Gen. Pl. **2:** 813 (1891). Type: Sierra Leone, *Mann 909* (K !).

Rhizome c. 5 mm diameter; stipe to 60 cm or more long, basal scales dark; lamina to 100 cm or more long, texture very firm; basal pinnae narrowed towards their bases; largest pinnae commonly 20 × 2,5 cm, base truncate, apex evenly attenuate, lobed to about 2 mm from costa, lobes dentate; costules 5–6 mm apart; veins to 20 pairs or more, basal 1 pair anastomosing, next pair to sides of membrane; costae usually hairless beneath but with ± persistent rather dark acuminate scales, costules more persistently covered with small scales, some filiform; upper surface of costa sparsely short-hairy. Sori medial, lower ones divergent; indusia small, glabrous; a red gland sometimes present at end of a hair on stalk of a sporangium.

Distribution: widespread in tropical Africa.

2. **Cyclosorus tottus** (Thunb.) Pic. Serm. in Webbia **23:** 173 (1968).—*Polypodium tottum* Thunb., Prodr. Pl. Cap.: 172 (1800).—*Thelypteris totta* Schelpe in Journ. S. Afr. Bot. **29:** 91 (1963); Fl. Zamb. Pterid.: 198 (1970) p.p.—*T. totta* var. *totta* A. R. Smith in Univ. Cal. Publ. Bot. **59:** 54 (1971). Type: S. Africa, *Thunberg* (UPS).

Differs from *C. striatus*: pinnae smaller, rarely to 2 cm wide, lobed about ½ way to costa or less deeply; veins 10–12 pairs; scales on lower surface of costae pale brown, often ovate-acute; small or filiform scales rare on costules.

Distribution: South Africa; occurrence in tropical Africa needs further study. *Cyclosorus gongylodes* (Schkuhr) Link, type from Guyana, is very similar, also specimens from Jamaica shown by T. G. Walker to be tetraploid (Trans. R. Soc. Edinb. **66:** 179; 1966). A. R. Smith has also found tetraploid plants in Florida.

3. **Cyclosorus interruptus** (Willd.) H. Ito in Bot. Mag. Tokyo **51:** 714 (1937), nomen tantum.—*Pteris interrupta* Willd. in Phytographia **1:** 13, t. 10, f. 1 (1794).—*Thelypteris interrupta* K. Iwats. in Journ. Jap. Bot. **38:** 314 (1963), nomen tantum; Fosberg & Sachet in Smiths. Contr. Bot. **8:** 8 (1972).—*Aspidium obtusatum* sensu Willd. in Linn. Sp. Pl. ed. IV, **5:** 241 (1810). Type: S. India, *Klein* (*Herb. Willd. no. 19, 770 B* !).

Aspidium obtusatum Sw. in Schrad. Journ. Bot. 1800 (2): 33 (1801); Syn. Fil.: 248 (1806). Type: Java, *Thunberg* (fragm. BM !).

Cyclosorus gongylodes sensu Alston, Ferns W. Trop. Afr.: 62 (1959) p.p.; sensu Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 288 (1958) p.p.

Thelypteris totta sensu Schelpe, Fl. Zamb. Pterid.: 198 (1970) p.p.

Differs from *C. tottus*: texture thinner; lower surfaces variously hairy; large red glands also often present.

Distribution in Africa uncertain. Manton found that a Ceylon plant, indistinguishable from Willdenow's south Indian type, was diploid (Phil. Trans. R. Soc. Ser. B, **238:** 138; 1954). Manton also found that a plant from Tanzania was diploid (Alston 1959: 80). Hairiness is very variable among specimens from Africa and Asia. Two different diploid genomes may exist, and there is the possibility that triploids may also occur; such plants, though sterile, could continue to grow for an indefinite period owing to the rhizomatous habit.

In 1933 Ching wrongly identified Willdenow's type with a quite different species which is widely distributed in Asia and Malesia (only known from Fernando Po in Africa, described in the present paper as *Amphineuron terminans*). The name *Cyclosorus interruptus* subsequently came into general use for this other species until the mistake was discovered by Fosberg and Sachet.

11. *AMPELOPTERIS* Kunze

Bot. Zeit. **6:** 114 (1848).

Fronds of indefinite apical growth, bearing many buds on rachis which form new plants freely; forked unicellular hairs present on rachis; pinnae subentire; veins almost all anastomosing, with few residual free veins running to margin; sori exindusiate, round or somewhat elongate along veins; hairs on stalks of sporangia bearing a terminal glandular cell; chromosome number 36.

One species, distributed throughout tropics of the Old World. This is the only Old World species which has forked unicellular hairs of the type characteristic of the New World genus *Goniopteris*. Its differences from *Goniopteris* are discussed in Holttum, Sen and Mittra, Blumea **18:** 196, 214 (1970).

1. **Ampelopteris prolifera** (Retz.) Copel., Gen. Fil.: 144 (1947); Alston, Ferns W. Trop. Afr.: 63 (1959); Schelpe, Fl. Zamb. Pterid.: 200, tab. 56 (1970); Tard. in Humbert, Fl. Madag. 5e Fam. **1:** 300 (1958).—*Hemionitis prolifera* Retz., Obs. Bot. **6:** 38 (1971).—*Meniscium proliferum* Sw., Syn. Fil.: 19, 207 (1806); Hook., 2nd Cent. Ferns: t. 15 p.p. (1861).—*Goniopteris prolifera* Presl, Tent. Pterid.: 183 (1836).—*Nephrodium proliferum* Keys., Pol. Cyath. Hb. Bung.: 49 (1873).—*Dryopteris prolifera* C. Chr., Ind. Fil.: 286 (1905); Sim, Ferns S. Afr. ed. 2: 99, t. 14 (1915).—*Cyclosorus proliferus* Tard. & C. Chr. in Notul. Syst. **14:** 346 (1952); Tard in Mem. Inst. Fr. Afr. Noire **28:** 128, pl. 22, fig. 11–13 (1953).—*Polypodium luxurians* Kunze in Linnaea **23:** 280 (1850), nom. nov. (not *P. proliferum* Kaulf.).—*Phegopteris luxurians* Mett., Farngatt. IV: 25 (1858). Type S. India, *Koenig* (GOET).

Ampelopteris elegans Kunze in Bot. Zeit. **6:** 114 (1848). Type: Java, *Zollinger 2360* (G !).

The small complete plant figured (as *Menicium proliferum*) by Hooker in 2nd Cent. Ferns, t. 15, also fig. 2 on the same plate, represents *Meniscium hosei* Bak. from Sarawak (*Pronephrium hosei* Holtt., Blumea **20:** 120. 1972).

Ampelopteris prolifera occurs throughout the wetter parts of tropical Africa, and in the Mascarene Islands.

12. *MENISORUS* Alston

Bol. Soc. Brot. Ser. 2, **30:** 20 (1956).

Caudex erect, short; frond simply pinnate with serrate pinnae, basal ones not reduced, apical lamina with a bud at its base; veins anastomosing; glabrous except upper surface of rachis and costae; sori exindusiate, spreading along veins; sporangia not setose; spores monelete with short laesura, or spherical, surface minutely papillose.

One species, widely distributed through tropical Africa on rocky stream banks.

1. **Menisorus pauciflorus** (Hook.) Alston in Bol. Soc. Brot. Ser. 2, **30:** 20 (1956); Ferns W. Trop. Afr.: 63 (1959).—*Meniscium pauciflorum* Hook., Spec. Fil. **5:** 164 (1864).—*Phegopteris pauciflora* Mett. ex Kuhn, Fil. Afr.: 123 (1868).—*Dryopteris pauciflora* C. Chr., Ind. Fil.: 283 (1905).—*Cyclosorus pauciflorus* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 247 (1941).—*Thelypteris pauciflora* Reed in Phytologia **17:** 302 (1968). Type: Cameroons, Sierra del Crystal, *Mann 1672* (K !).

Polypodium prionodes C. H. Wright in Kew Bull. 1906: 253. Type: Uganda, *Dawe 369* (K !).

Stipe 10–30 cm, basal scales broadly ovate, not hairy; lamina to 50 cm long, pinnae 15–25 pairs, apical lamina widened and lobed towards its base; pinnae commonly 6–9 cm long, 5–6 mm wide (type of *P. prionodes* 14 × 1 cm), edges serrate; costules 2½ mm apart, very oblique; veins 2 pairs; a few narrow scales on lower surface of costae; sori spreading all along first pair of veins.

Distribution: Congo, Cameroons, Sudan, Kenya, Uganda, Angola.

The spherical spores of this species, with scattered minute superficial papillae, closely resemble those of *Trigonospora* of S.E. Asia (Holttum, Blumea **19:** 29; 1971).

13. *PNEUMATOPTERIS* Nakai

Bot. Mag. Tokyo **47:** 179 (1953); Holtt., Blumea **19:** 42 (1971).

Caudex usually erect, in a few species creeping; scales usually broad, thin, with a few marginal hairs; very young fronds often covered with mucilage; stipe and lamina never conspicuously hairy; basal pinnae abruptly reduced, often many pairs; aerophores at bases of pinnae distinct, often ± swollen; lamina ± pustular when dry; veins anastomosing in all African species; superficial spherical glands lacking; sporangia sometimes bearing capitate hairs, rarely short acicular hairs, near annulus; on sporangium-stalks a hair of 2–4 cells, end cell swollen, rarely coloured; spores bearing many small wings.

More than 70 species, from W. Africa to Hawaii and Queensland, some in Malesia having free veins. A monograph of this genus, including the African species, is in course of publication in Blumea.

There are some aberrant species which I have felt obliged to include here. *P. afra* has setiferous sporangia, narrow hairy stipe-scales and spores irregularly winged; it is a tetraploid, and probably of hybrid origin. *P. unita* (*Goniopteris patens* Fée) has no reduced basal pinnae and aberrant spores, but it has the thin broad scales and pustular lamina normal in *Pneumatopteris*; the closely related *P. subpennigera*, similar in frond-form, does have spores like those normal in *Pneumatopteris*.

Indusia lacking:
Lowest pinnae not or little reduced:
A bud present near apex of rachis; sori mostly ± circular:
Pinnae lobed ¼–⅓, basal pinnae auricled; apical lamina not pinna-like 1. *P. unita*
Pinnae crenate, basal pinnae not auricled; apical lamina pinna-like . . . . 2. *P. blastophora*
No bud on rachis; sori elongate along veins . . . . 3. *P. subpennigera*
Lower 2–3 pairs pinnae gradually reduced . . . . 4. *P. oppositifolia*
Indusia present:
Rhizome wide-creeping; sporangia setose:
Pinnae crenate; 4–6 pairs veins anastomosing . . . . 5. *P. afra*
Pinnae lobed ⅓ or more; 2 pairs veins anastomosing . . . . 5a. hybrids
Rhizome erect or short-creeping; sporangia not setose:
Pinnae lobed distinctly less than ½ way to costa:
Lower surface bearing short hairs at least on costae:
Pinnae rigid with thick pale veins, to 3 cm wide, lobed to depth of 2½–3 mm 6. *P. humbertii*
Pinnae thin, with slender veins, not over 2½ cm wide, lobed to depth of 4–5 mm 7. *P. remotipinna*
Lower surface of pinnae quite glabrous . . . . 8. *P. usambarensis*
Pinnae lobed at least ½ way to costa:
Indusia glabrous; no capitate hairs on sporangia:
Lower pinnae narrowed towards an abruptly dilated base . 9. *P. venulosa*
Lower pinnae narrowed to a not-dilated base . . . . 10. *P. prismatica*
Indusia long-hairy; capitate hairs present on sporangia . . 11. *P. comorensis.*

1. **Pneumatopteris unita** (Kunze) Holtt., comb. nov.—*Gymnogramma unita* Kunze in Linnaea **18:** 115 (1844).—*Phegopteris unita* Mett., Farngatt. IV: 22 (1858).—*Polypodium unitum* Hook., Spec. Fil. **5:** 5 (1863), non Linn.—*Goniopteris unita* J. Sm., Hist. Fil.: 192 (1875).—*Goniopteris silvatica* Pappe & Rawson, Syn. Fil. Afr. Austr.: 39 (1858), nom. nov. superfl.—*Dryopteris silvatica* C. Chr.; Ind. Fil.: 292 (1905); Sim, Ferns S. Afr. ed. 2: 100, t. 15 (1915), not *D. unita* (L.) Kuntze.—*Cyclosorus silvaticus* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 249 (1941).—*Thelypteris silvatica* Reed in Phytologia **17:** 313 (1968). Type: Natal, *Gueinzius* (not seen).

Goniopteris patens Fée, Gen. Fil.: 253 (1852).—*Nephrodium patens* J. Sm., Hist. Fil.: 208 (1875) non Desv. 1827.—*Cyclosorus patens* Copel., Gen. Fil.: 143 (1947); Alston, Ferns W. Trop. Afr.: 62 (1959). Type: Natal, *Gueinzius* (not seen).

Goniopteris madagascariensis Fée, Gen. Fil.: 251 (1852).—*Aspidium malagassicum* Kuhn, Fil. Afr.: 136 (1868), nom. nov., not *A. madagascariensis* Fée.

—*Dryopteris madagascariensis* C. Chr., Ind. Fil.: 276 (1905).—*Cyclosorus madagascariensis* Ching, *l.c.* 246 (1941)—*Thelypteris madagascariensis* Schelpe in Journ. S. Afr. Bot. **31:** 267 (1965); Fl. Zamb. Pterid.: 196 (1970). Type: Madagascar, *Goudot* (not seen).

Nephrodium costulare Bak. in Journ. Linn. Soc. Bot. **16:** 203 (1877).—*Aspidium costulare* Kuhn in v. d. Deckens Reisen 3, **3:** 65 (1879).—*Dryopteris costularis* C. Chr.: Ind. Fil.: 258 (1905). Type: Madagascar, *H. Gilpin* (K !).

Dryopteris gladiata C. Chr. in Ark. for Bot. 14, no. **19:** 4, t. 1 (1916); Dansk. Bot. Ark. **7:** 52 (1932). Type: Madagascar, *Palm & Afzelius* (BM !).

Caudex erect; young coiled fronds covered with slime, linear aerophore on stipe white and swollen; stipe to 50 cm; lamina to 150 cm long, basal pinnae slightly reduced, deflexed, auricled on acroscopic side, narrowed on basiscopic. Largest pinnae to 25 × 3 cm, lobed $\frac{1}{4}$–$\frac{1}{3}$, costules 5–6 mm apart, veins 8–12 pairs; broad thin scales at first on lower surface of costae which also bear short hairs; a bud present on rachis near apex of frond. Sori near costules, lower spreading a little, exindusiate; spores with continuous wing and cross-wings.

Distribution: Madagascar, Natal, Mozambique, Rhodesia, Malawi, Tanzania, Kenya, Uganda, Congo, Cameroons Mt.

The correct name in *Thelypteris* for this species is *T. madagascariensis* (Fée) Schelpe.

2. **Pneumatopteris blastophora** (Alston) Holtt., comb. nov.—*Cyclosorus blastophorus* Alston in Bol. Soc. Brot. Ser. 2, **30:** 12 (1956); Ferns W. Trop. Afr.: 62 (1959).—*Thelypteris blastophora* Reed in Phytologia **17:** 264 (1968). Type: S. Nigeria, *Savory & Keay FHI 25,062* (BM !).

Caudex short-creeping, 5 mm diameter, fronds to 2 cm apart; stipe 30 cm, stramineous, sparsely hairy; lamina 65 cm long, pinnae 12 pairs; basal pinnae not reduced, rather abruptly narrowed to a cuneate base; apical lamina pinna-like but more deeply crenate than pinnae, a bud present at its base. Largest pinnae to 18 × 3,5 cm, base subtruncate to broadly rounded, apex short-cuspidate, edges crenate; costules 4–4$\frac{1}{2}$ mm apart, at wide angle to costa; veins to 8 pairs, 4 pairs anastomosing with zig-zag excurrent vein, 2 pairs to sides of sinus-membrane; minute erect hairs on lower surface of rachis and costae; very short hairs on upper surface of rachis and costae. Sori medial (in specimen from Liberia near costules), exindusiate, no hairs nor glands on sporangia; spores not seen.

Distribution: Liberia, Ghana, Fernando Po, Uganda.

Alston identified the Liberian specimen (W. J. Harley, F.188) as *Cyclosorus patens* (*Pneumatopteris unita*), but apart from the position of its sori it agrees closely with the type of *P. blastophora*, notably in crenate pinnae and venation.

3. **Pneumatopteris subpennigera** (C. Chr.) Holtt., Blumea **21:** (1974).—*Dryopteris subpennigera* C. Chr. in Dansk. Bot. Ark. **7:** 52, pl. 12, fig. 1, 2 (1932).—*Cyclosorus subpennigerus* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 249 (1941); Tard. in Humbert, Fl.Madag. 5e Fam. **1:** 298 (1958).—*Thelypteris subpennigera* Reed in Phytologia **17:** 318 (1968). Type: Madagascar, *Perrier 15,620* (P !, BM).

Differs from *P. unita*: no bud on rachis; sori medial, all elongate along veins; spores with many small wings.

Distribution: Madagascar and Comoro Islands.

4. **Pneumatopteris oppositifolia** (Hook.) Holtt., comb. nov.—*Polypodium oppositifolium* Hook., Spec. Fil. **5:** 8 (1863).—*Phegopteris oppositifolia* Kuhn, Fil. Afr.: 123 (1868).—*Goniopteris oppositifolia* J. Sm., Hist. Fil.: 192 (1875).—*Dryopteris oppositifolia* C. Chr., Ind. Fil.: 281 (1905).—*Cyclosorus oppositifolius* Tard. in Notul. Syst. **14:** 346 (1953); Alston, Ferns W. Trop. Afr.: 62 (1959). Type: San Tomé, *G. Mann* (K !).

Caudex short-creeping; stipe to 75 cm long, near base a swollen linear aerophore, scales small, hairy; lamina 75 cm long, pinnae to at least 30 pairs, opposite, lower 2–4 pairs gradually reduced, lowest 2½ cm long and 2½ cm wide at cordate base, apex of frond not pinna-like, no bud on rachis. Largest pinnae 22×2,3 cm, base auricled and subcordate on acroscopic side, caudate-acuminate, edges crenately lobed to depth of 1½ mm; costules 3½–4 mm apart; veins 8 pairs, 2 pairs anastomosing, 2 pairs to sides of membrane; lower surface of rachis and costae bearing short stiff hairs, costules and veins sparsely hairy; upper surface hairy only on costa. Sori inframedial, exindusiate, basal ones not divergent; sporangia rarely bearing short setae; spores as *P. unita.*

Distribution: San Tomé, Annobon Island, Fernando Po. This species show resemblances to both *P. afra* and *P. unita.*

5. **Pneumatopteris afra** (Chr.) Holtt., comb. nov.—*Dryopteris afra* Chr. in Bull. Soc. Bot. France **55,** Mem. 8b: 107 (1908).—*Cyclosorus afer* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 242 (1941); Alston, Ferns W. Trop. Afr.: 63 (1959).—*Thelypteris afra* Reed in Phytologia **17:** 258 (1968).—Lectotype: Congo, Haut-Oubangui, *A. Chevalier 5799* (P; K !).

Dryopteris dewevrei Chr. ex Bonap., Notes Pterid. **14:** 207 (1924).—*Cyclosorus dewevrei* Adams & Alston in Bull. Brit. Mus. (Nat. Hist.) Bot. **1:** 157 (1955). Type: Gabon, *Le Testu 1719* (P).

Caudex wide-creeping, 7 mm diameter, fronds c. 5 cm apart; stipe 35 cm, scales at base narrow, hairy; lamina 120 cm or more long; 2–3 pairs basal pinnae abruptly reduced and strongly auricled, lowest 1–2 cm long; aerophores white and slightly swollen on living fronds. Largest pinnae to 20 × 2,5 cm, base broadly cuneate, in lower pinnae auricled, apex caudate-acuminate, edges crenate to depth of 2 mm; costules 3½–4½ mm apart, at a wide angle to costa;

veins 10–12 pairs, 4–6 pairs anastomosing, sinus-membrane very short; sparse short hairs on lower surface of costae and costules, sometimes between veins; long hairs on upper surface of costae, few on costules. Sori medial; indusia hairy; sporangia bearing 2–3 setae near annulus; hair of 3 cells on sporangium stalk; spores irregularly winged.

Distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroons, Fernando Po, Congo, Angola, Uganda.

5a. Possible hybrids of *P. afra*. In Ghana, where *P. afra* and *Christella dentata* grow near together, Dr J. Ghatak has found a plant which is intermediate between them and shows irregular meiosis. Plants of similar aspect, with pinna lobed $\frac{1}{3}$–$\frac{2}{5}$, two pairs veins anastomosing and few setose sporangia, have been collected in Liberia (*W. J. Harley F.88*), Sierra Leone (*Morton & Macaulay 1712*), Ghana (*C. D. Adams 539*), Nigeria (*J. B. Hall 46*), Tanzania (*Newbould & Harley 4248*; *Verdcourt 3375*) and Uganda (*Chandler 1691*). Some of these have abortive spores. The following also appear to be possible hybrids of *P. afra*:

Thelypteris dentata var. *buchananii* Schelpe in J. S. Afr. Bot. **31:** 265, fig. 1d (1965), excluding specimens of Buchanan from Natal, which are *Christella altissima*. Type: Mozambique, *Schelpe 5599* (BOL). This is beyond the known range of *P. afra*.

Dryopteris wildemannii Chr. in Ann. Mus. Congo, Ser. V, **3:** 35 (1909). Type: Congo, Bena-Dibele, *Flamigni 62* (P !). Pinnae lobed about half-way to costa, to 11 × 2,0 cm, otherwise similar to the other specimens above cited (which have pinnae nearly as those normal for *P. afra*).

6. **Pneumatopteris humbertii** Holtt., sp. nov.—*Cyclosorus subpennigerus* (C. Chr.) Tard. in Humbert, Fl. Madag. Polypod. **1:** 298 (1958), p.p.

Caudex ignotus; stipes 20 cm longus usque pinnam reductam infimam; frons usque 100 cm longa. Pinnae inferiores 6-jugatae reductae, infimae 8 mm longae, superiores 2 cm vel ultra longae, basi truncata, 2,2 cm latae; pinnae evolutae inferiores 20 cm longae, 2,5–3,0 cm latae, basin versus non vel paulo angustatae, basi acroscopice non auriculatae, apice acuminatae non caudatae, $\frac{1}{5}$ costam versus lobatae, lobis leviter falcatis, integris, interdum apiculatis; costulae 5 mm inter se distantes, venae 8-10-jugatae, crassae, pallidae, $2\frac{1}{2}$–3-jugatae anastomosantes, venam excurrentem valde sinuatam facientes; costae subtus pilis brevibus rigidis praesertim distaliter vestitae, costulae venae laminaque pilis brevibus sparsim praeditae; costae supra hirsutae, costulae minute setiferae. Sori mediales, inferiores interdum divergentes at leviter elongati; indusia magna, glabra; sporangia eglandulosa.

Type: MADAGASCAR, partie occidentale du Massif de Marojejy, 1 400 m, *Humbert 31679* (K). Also *Humbert 22465*.

7. **Pneumatopteris remotipinna** (Bonap.) Holtt., comb. nov.—*Dryopteris remotipinna* Bonap., Notes Pterid. **5:** 57 (1917); C. Chr., Dansk. Bot. Ark. **7:** 50, pl. 12, f. 10 (1932).—*Cyclosorus remotipinna* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 248 (1941).—*Thelypteris remotipinna* Reed in Phytologia **17:** 398 (1968). Type: Madagascar, *Perrier 6072* (P !).

Dryopteris longifolia Bonap., Notes Pterid. **5:** 55 (1917), non Hieron. 1907.—*D. sambiranensis* C. Chr. in Perrier, Cat. Pl. Madag.: 25 (1932) nom. nov.; Dansk. Bot. Ark. **7:** 50, pl. 12, f. 11 (1932).—*Cyclosorus sambiranensis* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 248 (1941).—*Thelypteris sambiranensis* Reed in Phytologia **17:** 311 (1968). Type: Madagascar, *Perrier 7665* (P !).

Caudex erect; stipes 25–45 cm long, basal scales thin and flat; frond to 250 cm long with at least 8 pairs reduced and widely spaced lower pinnae, lowest 5–6 mm long, 5th pair 2,5 × 1,3 cm, triangular, not auricled. Largest pinnae 25–28 × 2,0–2,5 cm, lobed $\frac{2}{5}$ towards costa, lobes oblong with rounded tips; costules $4\frac{1}{2}$ mm apart; veins 10–11 pairs, $1\frac{1}{2}$–2 pairs anastomosing, 1 pair to sinus-membrane; some stiff red-brown hairs on lower surface of costae, also short pale hairs on costae, costules and sometimes between veins; upper surface hairy on costae only. Sori near costules, lower ones somewhat divergent; indusia glabrous; sporangia bearing large yellow capitate hairs; red glandular cells at ends of hairs on stalks of sporangia.

Distribution: Madagascar.

Christensen apparently only saw a distal pinna of the type (shown in his pl. 12, fig. 10) but the lower pinnae are much larger. The type has slender erect hairs all over the lower surface, but other specimens are less hairy. The glandular cells on sporangia and on hairs on their stalks are distinctive.

8. **Pneumatopteris usambarensis** Holtt., sp. nov.

Rhizome breve repens; stipes 30 cm longus, basi paleis parvis adpressis vestitus; frons 160 cm longa; pinnae inferiores 3-jugatae 5–8 mm longae, pinnae sequentes $3\frac{1}{2}$, $4\frac{1}{2}$, 10, 15 cm longae, omnes basi truncatae; pinnae maximae 30 cm longae, steriles usque 2,6 cm latae, fertiles 2,3 cm, basi leviter dilatatae, apice acuminatae, $\frac{1}{3}$–$\frac{2}{5}$ costam versus lobatae, lobis fertilibus subtruncatis leviter dentatis, sterilibus rotundatis integris; costulae 5–$5\frac{1}{2}$ mm inter se distantes, late patentes; venae 8–10-jugatae, 2-jugatae anastomosantes; pagina inferior omnino glabra. Sori paulo inframediales; indusia tenuia glabra vel pilis paucis praedita; sporangia pilis capitatis ornata.

Type: TANZANIA, E.Usambara Mts, 1 000 m, *Faden et al. 70/293* (EA, one frond on 7 sheets). Also on Usambara Mts *Greenway 4794*; *A. Braun 1427*; *A. Peter 159, 9999, 16859*; *C. Holst 4263, 2266.*

9. **Pneumatopteris venulosa** (Kuntze) Holtt., comb. nov.—*Nephrodium venulosum* Hook., Spec. Fil. **4:** 71 (1862), non Desv. 1827.—*Aspidium elatum* Mett. ex Kuhn, Fil. Afr.: 131 (1866), non Bojer 1837.—*Dryopteris venulosa* Kuntze,

Rev. Gen. Pl. **2:** 814 (1891), nom. nov.—*Dryopteris elata* C. Chr., Ind. Fil.: 263 (1905).—*Cyclosorus elatus* Alston, Bol. Soc. Brot. Ser. 2, **30:** 13 (1956); Ferns W. Trop. Afr.: 63 (1959).—*Thelypteris elata* Schelpe in Journ. S. Afr. Bot. **31:** 265 (1965).—*Thelypteris venulosa* Reed in Phytologia **17:** 323 (1968). Type: Fernando Po, *G. Mann* (K !).

Stipe to at least 40 cm long; reduced basal pinnae c. 4 pairs, lowest 1,5 cm long, uppermost 5 cm, auricled on acroscopic base. Largest pinnae 20 × 2,5–3,0 cm, lower ones narrowed in basal 4–5 cm and then dilated to basal width 2 cm, acuminate, lobed a little more than ½ way to costa; lobes oblique, oblong, ± dentate; costules 5 mm apart; veins 9 pairs, lowest pair anastomosing, 1 pair to sinus-membrane; rachis and costae ± hairy beneath. Sori inframedial; indusia thin, glabrous; sporangia lacking hairs near annulus.

Distribution: Fernando Po and S. Tomé.

Christensen regarded *A. elatum* Mett. as the correct basionym for this species, believing that *A. elatum* Bojer was a nomen nudum, but Bojer printed a brief description (see *Sphaerostephanos elatus* of present work).

10. **Pneumatopteris prismaticus** (Desv.) Holtt., comb. nov.—*Nephrodium prismaticum* Desv. in Mem. Soc. Linn. Paris **6:** 256 (1827).—*Dryopteris prismatica* C. Chr. in Dansk. Bot. Ark. **7:** 202 (1932).—*Cyclosorus prismaticus* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 248 (1941). Type: Mauritius, no collector cited (P !).

Aspidium caudiculatum Sieber ex Kunze, Linnaea **24:** 280 (1851).—*Nephrodium caudiculatum* Presl. Epim. Bot.: 46 (1851).—*Thelypteris caudiculata* Reed in Phytologia **17:** 266 (1968). Type: Mauritius, *Sieber 47* (orig. lost; dupl. K !).

Rhizome short-creeping; stipe 20 cm long; 3–4 pairs reduced pinnae at base of frond, lower orbicular, upper elongate, not auricled; lowest large pinna much narrowed towards their bases which are not dilated. Largest pinnae 17–23 × 2,2–2,5 cm, bases of middle pinnae sometimes dilated on basiscopic side, acuminate, lobed to a little more than half-way towards costa; lobes slightly oblique, slightly dentate; costules 4–5 mm apart; veins 6–8 pairs, one pair anastomosing, one pair to sides of membrane; lower surface glabrous. Sori medial; indusia glabrous; sporangia lacking glandular hairs.

Distribution: Mauritius, Réunion. This species is very close to *P. venulosa* but the pinnae are not so wide and are differently shaped at their bases.

11. **Pneumatopteris comorensis** Holtt., sp. nov.

Caudex verisimilter erectus; stipes 30 cm longus usque pinnam reductam infimam, paleis adpressis vestitus; pinnae reductae 4-jugatae, infimae 1 × 1 cm, superiores usque 2 × 1,5 cm, crenatae, non auriculatae; pinnae infimae evolutae basin versus non angustatae; pinnae maximae 33 × 3,0 cm, basi truncatae, caudato-acuminatae (cauda 2½ cm longa), dimidio vel paulo ultra versus costam lobatae; lobi non falcati, integri, apice rotundati, ciliati; costula 4½–5 mm inter se distantes; venae usque 12-jugatae, 1–1½-jugatis anastomosantibus; rachis subtus sparsim hirsutae, costae copiose costulae sparsim pilis patentibus vestitae. Sori mediales; indusia tenuia, longe-pilosa; sporangia pilis capitatis elongatis ornata.

Type: COMRO ISLANDS, Johanna, 200–800 m, *Hildebrandt 1782* (holotype K; dupl. B, L, FI).

EXCLUDED SPECIES

Nephrodium lucidum Bak., Gard. Chron. N.S. **8:** 456 (1877).—*Dryopteris lucida* C. Chr. Ind. Fil.: 276 (1905); Dansk. Bot. Ark. **7:** 49, pl. 12, fig. 8, 9 (1932).—*Cyclosorus lucidus* Ching in Bull. Fan Mem. Inst. Biol. Bot. **10:** 246 (1941).—*Thelypteris lucida* Reed in Phytologia **17:** 290 (1968). Type: cult. Hort. Bot. Kew. (K !).

This cultivated plant from which this was described was stated to have been sent to Kew from Madagascar, but it is unlike any other specimens found in Madagascar, and closely resembles *Aspidium laeve* Mett., described from a specimen from the Philippines (*Dryopteris luzonica* Chr. is a later name for the same species). Labels of plants in cultivation are easily misplaced, and I think this must have happened in the present case.

14. *AMPHINEURON* Holttum.

Blumea **19:** 45 (1971)

Caudex erect to long-creeping; fronds bipinnatifid, basal pinnae not reduced or 1–2 rudimentary and remote basal pinnae sometimes present; basal veins either free or anastomosing (in *A. opulentum* both conditions commonly in same frond); small capitate hairs present on lower surfaces, often acicular hairs also, not sessile spherical glands (in some Malesian species larger resinous glands present); sori usually confined to lobes of lamina, indusiate or not; sporangia never bearing hairs or glands near annulus; hair on sporangium-stalk of several cells with spherical glandular end-cell; spores irregularly tuberculate; chromosome number 36.

12–15 species, not yet all clearly defined, mainly in Malesia; two widely distributed species occur in Africa and islands.

Caudex short, suberect; apex of frond not pinna-like; pinnae lobed more than ½ way to costa; veins sometimes uniting, sometimes free . . . . 1. *A. opulentum*
Caudex long-creeping; apex of frond pinna-like; pinnae lobed less than ½ way; basal veins always anastomosing . . . . 2. *A. terminans.*

1. **Amphineuron opulentum** (Kaulf.) Holtt. in Blumea **19:** 45 (1971).—*Aspidium opulentum* Kaulf., Enum. Fil. Chamisso: 238 (1824).—*Thelypteris opulenta* Fosberg in Smiths. Contr. Bot. **8:** 3 (1972), excl. syn. *Nephrodium terminans* Wall. Type: Guam, *Chamisso* (LE).

Nephrodium impressum Desv. in Mem. Soc. Linn. Paris **6:** 259 (1827).—*Dryopteris impressa* Posth. in Verh. K. Akad. Wetens. Amst. **36,** 5: 14 (1937); Backer & Posth., Varen—fl. Java: 57 (1939). Type: Timor (P).

Aspidium extensum Bl., Enum., Pl. Jav.: 156 (1828).—*Nephrodium extensum* Moore, Ind. Fil.: 91 (1858); Bedd., Handb. Ferns Br. India: 269 (1883).—*Dryopteris extensa* Kuntze. Rev. Gen. Pl. **2:** 812 (1891).—*Cyclosorus extensus* Ching in Bull. Fan Mem. Inst. Bio. Bot. **8:** 182 (1938); Holtt. Rev. Fl. Malaya **2:** 264, fig. 150 (1955).—*Thelypteris extensa* Morton, Amer. Fern Journ. **49:** 113 (1959); Schelpe, Fl. Zamb. Pterid.: 193 (1970). Type: Pulo Pinang, *Blume* (L).

Lastrea malaccensis Presl, Epim. Bot.: 35 (1851). Type: Malacca, *Cuming 291* (PRC ! K !).

Nephrodium conionevron Fée, Gen. Fil.: 308 (1852). Ceylon, *Gardner 51* (not found).

Nephrodium punctatum Parish ex Bedd., Ferns Br. India: t. 131 (1866). Type: Moulmein, Burma, *Parish* (K !).

Nephrodium parasiticum var. *multijugum* Clarke in Trans. Linn. Soc. II Bot. **1:** 533 (1880). Type of var.: Penang, *Wallich 348* p.p. (K !).

Nephrodium wakefieldii Bak. in Ann. Bot. **5:** 326 (1891).—*Dryopteris wakefieldii* C. Chr., Ind. Fil.: 301 (1905). Type: Mombasa, *Wakefield* (K !).

Dryopteris sulfurea E. Brown in Bishop Mus. Bull. **89:** 23 (1931).—*Thelypteris sulfurea* Reed, Phytologia **17:** 318 (1968). Type: Marquesas, *Brown 193* (BISH !).

Caudex short-creeping; stipe to 70 cm, lamina to 80 cm with 15–25 pairs of pinnae; rarely 1 reduced basal pinna present; lower pinnae narrowed towards their bases. Largest pinnae to 25 × 2,5 cm, acuminate, lobed about $\frac{2}{3}$ towards costa, lobes oblique, slightly falcate; costules 4 mm apart (fertile) to 5–6 mm (sterile); veins 8–10 pairs, basal pair passing to sides of sinus-membrane or writing below it with a short excurrent vein; lower surface of rachis and costae bearing short hairs, scattered longer hairs on costules, costules and veins covered with small yellow capitate hairs, smaller colourless capitate hairs and/or acicular hairs on surface between veins; costae hairy on upper surface, scattered hairs on costules and veins. Sori confined to lobes, supramedial, in slight depressions in the lamina; indusia with small yellow glands on edges.

Distribution: throughout tropical Asia and Malesia, N. Queensland, eastwards to Society Islands and Marquesas; Seychelles; Kenya, Mozambique, Tanzania. A plant from Singapore was shown to be tetraploid.

2. **Amphineuron terminans** (Hook.) Holtt., comb. nov.—*Nephrodium terminans* Hook., Spec. Fil. **4:** 73 (1862); Bedd., Ferns S. India: t. 90 (1863). Type: Kamoun, *Wallich 386* (Herb. Hook. K !; no specimen in Herb. Wallich).

Nephrodium oreopteris Fée, Gen. Fil.: 306 (1852), non Desv. 1827. Type: Luzon, *Cuming 48* (orig?; dupl. K !).

Thelypteris wagneri Fosb. & Sachet in Smiths. Contr. Bot. **8:** 6 (1972). Type: Java, *Raciborski* (US).

Aspidium pteroides sensu Sw in Schrad. J. Bot. 1800 (2): 33 (1801), fide Ching, not *Polypodium pteroides* Retz.

Nephrodium pteroides sensu J. Sm., Cat. Cult. Ferns: 54 (1857); Bak., Syn. Fil.: 289 (1868) p.p.; Bedd., Handb. Ferns Br. India: 269 (1883); Racib., Fl. Btzg **1:** 183 (1898); not *Polypodium pteroides* Retz.

Dryopteris pteroides sensu C. Chr., Ind. Fil.: 287 (1905) p.p.; van Ald. van Ros., Handb. Mal. Ferns: 209 (1908); not *Polypodium pteroides* Retz.

Nephrodium unitum sensu Hook. & Arn., Bot. Beechey Voy.: 256 (1838); sensu Hook. Gen. Fil.: t. 48B, fig. 6 (1840); not *Nephrodium unitum* R.Br.

Dryopteris interrupta sensu Ching in Lingn. Sci. Journ. **12:** 566 (1933).—*Cyclosorus interruptus* sensu Ching in Bull. Fan Mem. Inst. Biol. Bot. **8:** 184 (1938); Holtt. Rev. Fl. Malaya **2:** 262, fig. 149 (1955); not *Pteris interrupta* Willd.

Dryopteris obtusata sensu Ballard, in Kew Bull. 1932: **75,** not *Aspidium obtusatum* Sw.

Rhizome long-creeping, 5–8 mm diameter; stipe to 50 cm or more long, scales 8 × 1 mm, thin, hairy; lamina to 80 cm long, apex pinna-like, pinnae to 25 pairs, lowest pair ± reduced. Largest pinnae commonly 17–20 × 1,7–2,0 cm (to 30 × 2 cm), base cuneate in lower pinnae, truncate in upper, lobed $\frac{1}{4}$–$\frac{1}{3}$ towards costa, lobes oblique, falcate, broadly pointed; costules 4–5 mm apart at 60° or less; veins 6–9 pairs, basal pair anastomosing, next pair to sides of sinus-membrane; lower surface throughout bearing very short erect hairs, capitate hairs abundant only on distal parts of veins, especially near apices of pinna-lobes; upper surface hairy on costae, scattered hairs on costules, veins and on surface near edge. Sori close to margins of pinna-lobes, not on basal veins; indusia large, glabrous or with short hairs.

Distribution: Ceylon and India; Burma to S. China; throughout Malesia to New Guinea; in Africa only known from one collection from Central African Republic and one from Fernando Po (K). Plants in Ceylon were found to be tetraploid.

15. *SPHAEROSTEPHANOS* J. Smith

Hook. Gen. Fil.: t. 24 (1839); Holtt., Blumea **19:** 29 (1971)

Caudex various, scales always narrow and hairy; fronds with varying number of much-reduced basal pinnae; aerophores often swollen, young fronds sometimes mucilaginous; veins usually anastomosing; lamina not pustular when dried; surfaces always ± hairy, hairs on upper surface, where present, appressed antrorse; sessile spherical glands variously present on both surfaces, indusia and sporangia, but sometimes replaced by short acicular hairs; on stalk of sporangium a hair of 3–4 cells, end cell swollen but not spherical; spores covered with many small wings.

More than 120 species; San Tomé, E. Africa, Madagascar and Mascarene Islands; southern India and Ceylon, Burma to S. China, throughout Malesia and the Pacific to Tahiti, with greatest number of species in New Guinea.

The generic name *Sphaerostephanos* was given to a species of Western Malesia which has elongate sori, but this character is not a sharply distinctive one. The name refers to the fringe of spherical glands on the indusia of the type species.

- Caudex erect:
  - Pinnae less than 2 cm wide, crenate . . . . 1. *S. arbuscula*
    - Many spherical glands on upper surface; larger pinnae auricled at base . . . . subsp. *arbuscula*
    - Few glands on upper surface; larger pinnae not auricled . . subsp. *africanus*
  - Pinnae to 2,5 cm wide, lobed half way to costa . . . . 2. *S. subtruncatus*
- Caudex long-creeping:
  - Pinnae rarely over 1,5 cm wide, lobed less than half way to costa; glands present on lower surface and on sporangia . . . . 3. *S. unitus*
  - Pinnae to at least 2 cm wide, lobed half way to costa; no glands on surfaces; sporangia setose . . . . 4. *S. elatus*
    - Pinnae to 30 cm long; hairs on rachis and costae rather sparse, ½ mm long; few hairs on indusia . . . . subsp. *elatus*
    - Pinnae to 15 cm long; dense very short hairs on rachis and costae with some longer ones; indusia densely short-hairy . . . . subsp. *thomensis*

1. **Sphaerostephanos arbuscula** (Willd.) Holtt., comb. nov.—*Aspidium arbuscula* Willd. in Linn. Sp. Pl. ed. IV, **5:** 233 (1810).—*Nephrodium arbuscula* Desv. in Mem. Soc. Linn. Paris **6:** 253 (1827); Beddome, Handb. Ferns Br. India: 276 (1833).—*Dryopteris arbuscula* Kuntze, Rev. Gen. Pl. **2:** 812 (1891).—*Cyclosorus arbuscula* Ching in Bull. Fan Mem. Inst. Biol. Bot. **8:** 194 (1938).—*Thelypteris arbuscula* K. Iwats. in Acta Phytotax. Geobot. **21:** 170 (1965). Type: Mauritius, *Herb. Willd. no. 19,763* (B !).

Nephrodium hookeri Houlst. & Moore in Gard. Mag. Bot. **3:** 294 (1851). Type: cult. (BM).

Aspidium hookeri Wall. ex Hook. Ic. Pl. **10:** t. 922 (1854), non Sweet 1830. Type: S. India, Dindigal, Herb. Wight Crypt. 116; Wall. Cat.: 64, no. 338 (K !).

Subsp. *arbuscula*. Caudex erect, to 30 cm or more tall; stipe 5–10 cm, densely short-appressed-hairy; lamina 40–60 cm or more long, 5–10 pairs lower pinnae gradually reduced, all auricled at acroscopic base. Largest pinnae 6–10 cm long, 7–12 mm wide above base, base distinctly auricled, acuminate to a rather blunt tip; edges crenate to a depth of 1–1½ mm; costules commonly 3–3½ mm apart, at c. 50° to costa; veins 4–6 pairs, 1½ pairs anastomosing, next to side of short sinus-membrane; lower surface of rachis and costae densely short-hairy, sparse hairs on costules and veins, spherical glands throughout;

glands also throughout upper surface. Sori medial; indusia glandular and short-hairy; yellow glands on sporangia.

Distribution: Mauritius, Réunion, Madagascar, Ceylon, S. India. Some specimens from Madagascar have pinnae very slightly crenate.

Subsp. *africanus* Holtt., subsp. nov. a subspecie arbuscula differt: pinnis majoribus (usque 16 × 1,7 cm) basi utroque latere leviter dilatatis, acroscopice non auriculatis, glandulis supra paucis. Type: Kenya, Kwale Distr., Shimba Hills, 300 m, *Drummond & Hemsley 1203* (K).

Distribution: Tanzania (N. Uluguru Mts, E. Usambara Mts), Kenya.

2. **Sphaerostephanos subtruncatus** (Bory) Holtt. in Kew Bull. **26:** 80 (1971).—*Polypodium subtruncatum* Bory in Bél. Voy. Ind. Or., Bot. **2:** 32 (1833). Type: India, Madeira, Mts de Dendigall, *Bélanger* (P !).

Dryopteris mauritiana var. *gardineri* C. Chr. in Trans. Linn. Soc. II Bot. **7:** 413 (1912). Type: Seychelles, *J. S. Gardiner* (K !).

Mesochlaena polycarpa sensu Blatter & d'Almeida, Ferns of Bombay: 124, fig. 41 (1912), non (Bl.) Bedd.

Caudex erect; base of stipe to first reduced pinna 10 cm, to first large pinna 65 cm; reduced pinnae to 15 pairs, smallest 5 mm long, largest $3\frac{1}{2}$ × 2 cm, base truncate and somewhat auricled on acroscopic side; lamina to 120 cm long excluding reduced pinnae, pinnae 35 pairs. Largest pinnae 12 × 2,5 cm, widest at truncate base, acuminate, lobed about $\frac{1}{2}$ way to costa, lobes oblong, hardly falcate, tips rounded; costules 4 mm apart; veins to 10 pairs, $1\frac{1}{2}$ pairs anastomosing, $\frac{1}{2}$–1 pair to sides of membrane; sessile spherical glands present throughout lower surface, copious short hairs on rachis and costae, few on costules and veins; upper surface of costae hairy, few hairs on costules and veins, not between veins, no glands. Sori medial, slightly elongate along veins; indusium large, glabrous or with a few short hairs; sporangia bearing yellow glands.

Distribution: S. W. India, Seychelles. The above description is based on Seychelles specimens. Plants from India show considerable variation in size of fronds; Beddome collected one with pinnae to 27 × 2,4 cm (he labelled it *Nephrodium truncatum* var.?) but others are much smaller.

3. **Sphaerostephanos unitus** (Linn.) Holtt., comb. nov.—*Polypodium unitum* Linn., Syst. Nat. ed X, **2:** 1326 (1759) excl. syn.—*Aspidium unitum* Sw. in Schrad. Journ. Bot. 1800 (2): 32 (1801), *nomen tantum*.—*Nephrodium unitum* R. Br., Prodr. Fl. N. Holl.: 148 (1810), *nomen tantum*.—*Polystichum unitum* Gaud. in Freyc. Voy. Bot.: 325 (1827) excl. syn.—*Aspidium propinquum* R. Br. and *Tectaria serrata* Cav.—*Dryopteris unita* Kuntze, Rev. Gen. Pl. **2:** 811 (1891).—*Cyclosorus unitus* Ching in Bull. Fan Mem. Inst. Biol. Bot. **8:** 192 (1938).—*Thelypteris unita* Morton in Amer. Fern Journ. **49:** 113 (195). Type: without locality, in Herb. Linn. (!).

Nephrodium insculptum Desv. in Mem. Soc. Linn. Paris **6:** 254 (1827). Type: Réunion, no collector named (P !).

Aspidium cucullatum Bl., Enum. Pl. Jav.: 151 (1828).—*Nephrodium cucullatum* Bak., Syn. Fil.: 290 (1867); Bedd. Handb. Ferns Br. India: 270 (1883). Type: Java, *Blume* (L).

Nephrodium haenkeanum Presl, Epim. Bot: 46 (1851); Holtt. in Novit. Bot. Inst. Bot. Univ. Carol. Prag. 1968: 17 (1969).—*Aspidium haenkeanum* Journ. in Ann. Sci. Nat. Ser. V, **18:** 298 (1873).—*Dryopteris haenkeana* Kuntze, Rev. Gen. Pl. **2:** 812 (1891).—*Cyclosorus haenkeanus* Ching in Bull. Fan Mem. Inst. Biol: Bot. 194 (1938).—*Thelypteris haenkeana* Reed in Phytologia **17:** 281 (1968). Type: Philippines, *Haenke* (PRC !).

Aspidium unitum Sieber ex Mett., Farngatt. IV: 107 (1858).—*Nephrodium unitum* Hook., Spec. Fil. **4:** 81 (1862). Type: Mauritius, *Sieber 43* (B?; K!).

Nephrodium leuconeuron Fée, Gen. Fil.: 306, t. 18C, fig. 3 (1852).—*Aspidium leuconeuron* Kuhn, Fil. Afr.: 136 (1868).—*Dryopteris leuconeura* Nakai in Bot. Mag. Tokyo **47:** 180 (1933).—*Thelypteris leuconeura* Schelpe in Journ. S. Afr. Bot. **31:** 266 (1965) excl. syn. *Nephrodium mauritianum* Fée. Type: Réunion, *Olivier* (not seen).

Other names of Fée which are possible synonyms are: *N. microcarpum* Fée op. cit. 307; *N. plectochlaena* Fée, op. cit. 307; both types from Réunion, not seen.

Caudex long-creeping, 5 mm diameter or more; stipe 10–20 cm to lowest reduced pinna; reduced pinnae 6 or more pairs, lowest very small, upper ones triangular with wide base, widest on acroscopic side, transition to large pinnae abrupt; lamina 30–60 cm or more, excluding reduced pinnae, texture firm. Largest pinnae commonly 10–15 × 0,9–1,3 cm (sometimes to 20 × 2 cm), base broadly cuneate, apex evenly attenuate, lobed about $\frac{1}{3}$ towards costa, lobes rounded and slightly pointed; costules commonly 3–3$\frac{1}{2}$ mm apart, at wide angle to costa; veins 8–10(–14) pairs, 1$\frac{1}{2}$ pairs anastomosing, next 2–4 pairs to sides of sinus-membrane; lower surface of rachis and costae copiously hairy, costules and veins with shorter hairs, also small yellow glands; upper surface only hairy on costae. Sori supramedial; indusia firm, usually with short hairs; sporangia bearing yellow glands.

Distribution: Tanzania; Madagascar, Mauritius, Réunion, Rodriguez, Seychelles; Ceylon & S. India; Assam & Burma to Tonkin; throughout Malesia; in Pacific to Marianas, Tonga, Fiji and New Caledonia.

Nephrodium haenkeanum Presl was based on a specimen with broad pinnae, but otherwise typical. Specimens in S. India and Ceylon have larger glands on the lower surface than in Malesia; the Linnean type resembles S. India specimens. The literature references cited by Linnaeus certainly refer to specimens of *Cyclosorus* (s. str. of the present work), but his specimen is regarded as fixing the name. During the 19th century the name was interpreted in both ways, with consequent confusion. Some 19th century authors also did not learn how to distinguish the present species from *Aspidium aridum* Don; the latter is a species of *Christella* and has elongate glands on the lower surface. Published distribution records are thus often unreliable.

4. **Sphaerostephanos elatus** (Bojer) Holtt., comb. nov.—*Aspidium elatum* Bojer, Hort. Maurit.: 390 (1837).—*Nephrodium elatum* Bak., Syn. Fil. ed. **2:** 502 (1874), non Bak. 1867; Bak. in Fl. Maurit. & Seych.: 498 (1877). Type: Mauritius, *Bojer* (W).

Aspidium maximum Bojer ex Bak., Syn. Fil. ed. **2:** 502 (1874). Type: Mauritius, *Bojer* (K !).

Nephrodium mauritianum Fée, Gen. Fil.: 308 (1852), non Desv. 1827.—*Aspidium mauritianum* Kuhn, Fil. Afr.: 136 (1868), non Desv. 1827.—*Nephrodium elatum* var. *mauritianum* Bak., Fl. Maurit. & Seych.: 499 (1877).—*Dryopteris mauritiana* C. Chr., Ind. Fil.: 277 (1905), nom. nov.; Trans. Linn. Soc. II Bot., **7:** 413 (1912); Dansk. Bot. Ark. **7:** 51 (1932).—*Cyclosorus mauritianus* Ching in Bull. Fan Mem. Inst. Biol. **10:** 246 (1941).—*Thelypteris mauritiana* Reed in Phytologia **17:** 291 (1968). Type: Mauritius, *de Montbrison* (not seen).

Nephrodium procerum Bak., Syn. Fil. ed. **2:** 502 (1874), non Don 1825. Type: Mauritius, *Bojer* (K !).

Subsp. *elatus*. Caudex long-creeping, to 1 cm diameter; at base of frond c. 6 pairs of strongly trilobed much-reduced pinnae, lowest large pinna narrowed to base on basiscopic side, not auricled. Largest pinnae 20–35 × 2,0–3,5 cm; base broadly cuneate, not auricled; apex acuminate and serrate; lobed halfway to costa; lobes strongly falcate, narrowed slightly towards an abruptly broad-pointed apex; costules 5–6 mm apart; veins 14 to 18 pairs, basal 1½ pairs anastomosing, next 1–1½ pairs to sides of long membrane; lower surface with rather sparse spreading hairs on rachis, costae and costules, erect hairs between veins; longer antrorse hairs on upper surface of costae and similar hairs sparsely on costules and veins, a variable number of short hairs between veins (most on sterile pinnae). Sori inframedial; indusia large with a few hairs; sporangia bearing short setae.

Distribution: Mauritius, Réunion, Rodriguez. The type of *A. maximum* has pinnae 35 × 3,2 cm, with 18 pairs of veins; that of *N. procerum* Bak. has pinnae 21 × 2,0 cm; a specimen of a young plant from Réunion, already fertile, is still smaller, with a reduced number of small basal pinnae.

Subsp. *thomensis* Holtt, subsp. nov. a subsp. elato differt: pinnis usque 15 × 2,0 cm, costulis 4 mm inter se distantibus, venis 10-jugatis; rachide, costis infimis, indusiisque, pilis minutis erectis densis vestitis. Type: San Tomé, *A. Moller s.n. 1885* (P).

NEW SPECIES DESCRIBED

Parathelypteris salazica (from Reunion); *Pseudocyclorous camerounensis*, *P. johannae; Christella altissima* (Natal), *C. modesta* (Madagascar); *Pneumatopteris humbertii* (Madagascar), *P. usambarensis* (Tanzania), *P. comorensis*.

NEW COMBINATIONS. *Metathelypteris fragilis* (Bak.) Holtt.; *Amauropelta membranifera* (C. Chr.) Holtt., *A. heteroptera* (Desv.) Holtt., *A. bergiana* (Schlechtend.) Holtt. (with new varieties *calva* and *tristanensis*), *A. strigosa* (Willd.) Holtt., *A. tomentosa* (Thouars) Holtt., *A. oppositiformis* (C.Chr.) Holtt.; *Pseudocyclosorus pulcher* (Bory ex Willd.) Holtt.; *Christella distans* (Hook.) Holtt., *C. hilsenbergii* (Presl) Holtt., *C. dentata* (Forsk.) Holtt., *C. guineensis* (Chr.) Holtt., *C. friesii* (Brause) Holtt., *C. multifrons* (C. Chr.) Holtt., *C. afzelii* (C. Chr.) Holtt., *C. callensii* (Alston) Holtt., *C. microbasis* (Bak.) Holtt., *C. gueinziana* (Mett.) Holtt., *C. chaseana* (Schelpe) Holtt.; *Pneumatopteris unita* (Kunze) Holtt., *P. blastophora* (Alston) Holtt., *P. subpennigera* (C. Chr.) Holtt., *P. oppositifolia* (Hook.) Holtt., *P. afra* (Chr.) Holtt., *P. remotipinna* (Bonap.) Holtt., *P. venulosa* (Kuntze) Holtt., *P. prismatica* (Desv.) Holtt.; *Amphineuron terminans* (Hook.) Holtt.; *Sphaerostephanos arbuscula* (Willd.) Holtt., *S. unitus* (Linn.) Holtt., *S. elatus* (Bojer) Holtt. (with subsp. *thomensis*).